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HOOKWORM DISEASE

(OR GROUND-ITCH ANEMIA)

ITS NATURE, TREATMENT AND PREVENTION

BY

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HOOKWORM DISEASE

(OR GROUND ITCH ANEMIA):

ITS NATURE, TREATMENT, AND PREVENTION.

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INTRODUCTION.

The present paper is prepared to meet a constantly increasing demand for a general discussion on hookworm disease. It is intended primarily for physicians. For further details the reader is referred to the bibliography at the end of this paper.

CAUSE OF HOOKWORM DISEASE.

Hookworm disease, known technically as Uncinariasis, is caused by small round worms belonging to the subfamily *Uncinariinæ*. There are a number of different species of hookworms known for various animals, as man, dogs, cattle, sheep, swine, seals, etc., but the forms which occur in man are peculiar to man and do not reach maturity in our domesticated animals; neither do the forms which occur in the latter develop to maturity in man.

For man, two different species of hookworms are known, namely, the New World form (*Necator americanus*) and the Old World form (*Agchylostoma duodenale*). The vast majority of cases of hookworm disease in man in the United States are due to the New World hookworm; but occasionally cases are found which are caused by the Old World parasite. The latter cases are usually, if not always, found either among immigrants or in native-born Americans who have been outside the United States.

The New World hookworm (figs. 1, 14, and 15) is a slender worm, about half an inch long and scarcely thicker than a small-sized hairpin.

In its adult stage the parasite lives in the small intestine, especially in the upper half, occasionally also in the stomach. It attaches itself to the intestinal wall, wounds the mucosa, sucks the blood, eats the epithelium, and, according to present evidence, it apparently produces a poisonous substance which injures the host.

SYMPTOMS.

At least two distinct stages must be recognized for hookworm disease; but in case of repeated infections both stages may be present at the same time. These stages are the *cutaneous* (p. 7) and the *intestinal* stage (p. 7).

CUTANEOUS STAGE.

The young hookworm larvæ (fig. 16) may gain entrance to the body either through the skin or by being swallowed. When they enter through the skin they cause a condition known in the South as "ground itch," "foot itch," "toe itch," "dew itch," "dew poison," etc.

"Ground itch" has not been thoroughly studied as yet. It is, however, established beyond question that numerous cases of ground itch are due to hookworm invasion. In addition there are many cases of so-called "ground itch" which do not appear to be followed by the intestinal stage of hookworm disease. The explanation of this is not as yet altogether clear; but several possibilities suggest themselves. The possibility is, for instance, present that some cases of ground itch are due to the parasite of Cochin-China diarrhea

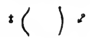


FIG. 1.—Male and female hookworms (*Necator americanus*), natural size.

(*Strongyloides stercoralis*), which is very common in some tropical and subtropical countries. Again, it is by no means impossible that the hookworms of some of our domesticated animals may cause ground itch in man, although no case has been found in which these parasites reach maturity in the human being. Still a third possibility is that what we now term "ground itch" may eventually prove to cover a number of distinct conditions, the causes of which are at present not thoroughly understood.

In my experience about 87 per cent of hookworm cases definitely admit a history of ground itch.

Treatment of ground itch is not altogether satisfactory, if by satisfactory treatment is meant an abortion of the disease. The local irritation can be somewhat relieved, although the young hookworms will not thereby be killed. The infected portion should be kept thoroughly clean, as by washing with warm water and green soap, and then treated with some disinfecting substance, such as carbolized vaseline, zinc ointment, etc.; in addition it is well to bandage the infected area and to have the patient wear shoes and stockings, in order to prevent him from scratching the lesion.

INTESTINAL STAGE.

From the skin the young parasites wander to the intestine, as described on pages 37–38. Their effects upon the patient vary according to the physical condition of the latter, the intensity of infection, and perhaps also according to other factors not yet thoroughly understood. The "dirt eater"[a] represents the typical extreme case of hookworm disease, and the intensity of symptoms may vary from those observed in the "dirt eater" to cases in which the patient is not aware of any subjective symptoms, and in which the infection may not even be suspected until found by a chance microscopic examination.

The description of the symptoms given here is based, in general, upon the severe infections as found in the white race. The symptoms may, of course, be less intense in lighter cases.

In general, the patient, if infected before puberty, is retarded in his development, both physical and mental, and shows a more or less extreme anemia. A person 21 years of age may appear not better developed than one 14 to 18 years old.

EXTERNAL APPEARANCE.—*Skin:* In general, the skin is dry, and there is a noticeable absence of perspiration. The color may be waxy white to dirty yellow; it has a resemblance to tallow, especially on the forehead and on the alæ of the nose, and the observer seems to look through the superficial layer down into a deeper layer. Atrophic areas of the skin may be seen in cases of long standing.

Hair: The hair of the head is dry, reminding one of hemp. The beard, axillary, and pubic hairs may be very late and scant of growth.

Edema: Edema may be present on the face, feet, legs, scrotum, or entire body. It seems to be especially common over the cheek bones, and may frequently be noticed even in photographs.

Wounds and ulcers.—If a skin wound is present, it is likely to be rather slow in healing. Many of the patients (about 57 per cent of the well-marked cases) either show tibial ulcers or give a history of such lesions.

Head: The face is likely to show an anxious, ofttimes stupid expression. Dark lines under the eyes are common. The visible mucous membranes may be chalky white. The pupils show a tendency to dilatation, even when facing a strong light; many patients exhibit a peculiar blank stare; night blindness is reported in a number of instances. There is likely to be an edema over the cheek bones. The line of demarcation between the lips and skin may entirely disappear.

Neck: Cervical pulsation may be very prominent, and is frequently visible 6 to 12 feet distant.

[a] "Dirt eating" may, of course, develop from causes other than hookworm disease.

Thorax: The thorax may be so emaciated that the ribs stand out very prominently. The shoulders droop and are thrown forward; the shoulder blades stand out prominently (winged shoulder blades); frequently the observer can sink his entire hand below the median margin of the scapulæ, and even run his fingers for a distance between this margin and the ribs.

Abdomen: In many instances the abdomen is so swollen as to remind one of pregnancy. This condition is known locally as "pot-belly," "buttermilk-belly," or "shad-belly."

Digestive system.—The appetite varies exceedingly. There is a decided tendency to the development of an unusual desire for articles

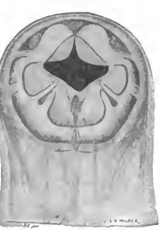


Fig. 2.

Fig. 3.

Fig. 2.—Greatly enlarged view of the head. The upper, rather quadrangular structure represents the mouth: just below are seen 4 cutting plates, or jaws, arranged in pairs and usually called lips, by means of which the worm attaches itself to the lining of the intestine; in the median line is seen a conical tooth-like projection, on the summit of which a gland opens. Original.

Fig. 3.—The same view, but at slightly deeper plane, showing the buccal cavity; one pair of plates and the "dorso-median tooth" stand out very prominently: at the side of this "tooth" is seen a pair of lancets. Original.

of food in some particular line, as for pickles, coffee, lemons, etc.; in very severe cases this tendency may take the direction of "dirt-eating," that is, the patient may eat wood, sand, clay, chimney soot, plaster, cotton, wool, etc.; one case, in which a boy ate three coats, thread by thread, in one year's time, has come under my personal observation. Usually patients will deny this habit, even when evidence of it is found in their mouth. I am now becoming persuaded that some of the tobacco chewing and snuff dipping, found in certain sections of the country, has its origin directly or indirectly in hookworm disease, for I have known of cases where parents taught

their children (one case, a boy 4 years old) to dip snuff and to chew tobacco in order to prevent them from "growing pale."

The stomach is enlarged in many cases. "Heartburn" and flatulence are common. Nausea and vomiting are reported. Pain and tenderness in the epigastrium are present. Ashford, King, and Gutierrez (1904) give this as "the most constant, most suggestive, and most clearly marked of all symptoms of the digestive tract." The tenderness is more marked on inspiration; it is median and continues toward the right, but is less marked and may even disappear toward the left. Frequently patients will shrink from the mere weight of the observer's hand at the points in question. Frequently there is tenderness on expiration in the eleventh dorsal intercostal space.

Fig. 4.

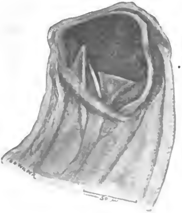


Fig. 5.

FIG. 4.—The same view, but at still deeper focus, and the specimen is in slightly different position. The four structures in the center represent the bases of the four lancets which guard the entrance to the esophagus, which is seen in the background. Original.

FIG. 5.—Lateral view of the head, at deep focus. In the buccal cavity are seen the prominent dorsomedian tooth and one of each pair of lancets guarding the entrance to the esophagus. By means of its powerful esophagus, the worm sucks down a portion of the intestinal wall into this buccal cavity against these pointed structures, as may occasionally be observed under the microscope. Original.

Constipation is so common that in some localities hookworm disease is known as "constipation;" diarrhea may, however, be present.

The feces vary in color. Authors are not in accord in regard to the presence of blood in the stools. The Porto Rican Commission found blood microscopically in only 6 cases and blood and mucus in 5 cases in over 22,000 fecal examinations. I have kept no statistics on this point, but I have frequently and repeatedly found blood, and there are autopsy records of large clots of blood in the intestinal canal.

CIRCULATORY SYSTEM.—The apex beat is pronounced in light cases; in moderate cases it may be displaced downward and to the left; in marked cases there is a reduction in the force of the apex beat, which is replaced by a wavy, indefinite pulsation in the epigastrium, or an impulsive, tumultuous heaving of the whole pericardium, and in these cases cyanosis, chiefly in the lips, may be noticed; a presystolic thrill is not infrequent in moderate and especially in severe cases (Ashford, King, and Gutierrez); in moderate cases, hypertrophy, especially of the left ventricle, causes an enlargement of the heart area; the murmurs are best heard in the third intercostal space; in moderate cases, hemic murmurs are almost always present (Ashford, King, and Gutierrez). Palpitation occurs early and is very prominent and constant. Dyspnea is very common, especially in the later stages.

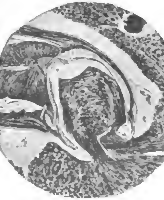


FIG. 6. Section through a worm, showing how it attaches itself to the intestinal wall. After a photograph by Dr. W. M. Gray, published by Gutierrez, Martinez & Sein, 1907.

The pulse varies from 80 to 132, without any necessary relation to the temperature; in later stages it becomes dicrotic, then weak and compressible, finally thready, irregular, and intermittent.

Blood: One of the most pronounced symptoms is the anemia, which is so common and prominent that it has been taken as basis for several vernacular names of the disease (miner's anemia, brickmaker's anemia, etc.); the common "cotton mill anemia" of our Southern States, popularly attributed to "breathing in the cotton lint," is nothing more nor less than hookworm disease.

For detailed descriptions of the blood condition, the reader is referred to the Porto Rican reports. In brief, in one series of 540 persons, compared as to race, Ashford, King, and Gutierrez (1904) found that the hemoglobin averaged 45 per cent in whites, over 44 per cent in mulattoes, and over 49 per cent in negroes. Of 577 per-

sons, the males averaged 41 per cent, the females 48 per cent in hemoglobin. In one case only 8 per cent is recorded. During the disease the hemoglobin falls before the red cell count, and may reach as low as 30 per cent before much change is noticed in the red blood corpuscles. In 26 cotton mill cases, Coward and I recently examined, the average was 62.6 per cent.

The red cells may fall as low as 754,000. In Porto Rico, 61 specially selected cases averaged 2,406,416. In 26 cotton mill cases in South Carolina, Coward and I found an average of 3,910,427. The red cells become polychromatophilic and show poikilocytosis.

The white cells usually vary from 5,000 to 10,000; leukopenia may be present in chronic cases. Little or no eosinophilia may be pre-

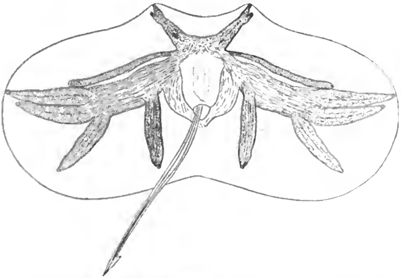


FIG. 7.—View of the umbrella-like expansion (bursa) on the tail of the male. Original.

sent in severe chronic cases with poor resisting power and exhausted blood-making organs; the Porto Rican Commission interprets a rise in eosinophiles as of good prognostic import; their "special" cases averaged 10.8 per cent before treatment and 13.2 per cent after treatment; this commission found the following averages in 29 cases, before treatment: Eosinophiles, 17.1 per cent; polymorphonuclears, 54.5 per cent; small lymphocytes, 16.3 per cent; large lymphocytes, 8.6 per cent; other leucocytes, 3.5 per cent.

RESPIRATORY SYSTEM.—Patients may complain of difficulty in breathing, especially after exertion.

TEMPERATURE.—The temperature may be normal, subnormal, or may reach 100° to 102° F.

Nervous system.—Mental lassitude, headache, and dizziness are frequently noticed, and patients are frequently noticeably timid. The effect upon the mind may be very marked. Children at school complain that it is difficult for them to study. Upon my examining school children for uncinariasis, the remark is frequently made to me by the teacher that I have picked out "the most stupid children in the school." The tendency of the children to ask to have a question

Fig. 8.—Lateral view of the tail of the male. Original.

repeated and then to repeat it themselves, before answering, is very marked.

The patellar reflex may be diminished or suppressed; tingling and formication may be present; either insomnia or somnolence may be marked; dizziness is common, especially upon suddenly rising to the feet; joint pains are common.

Muscular system.—The hand grip is weak and can not be long sustained. The muscles are weak and flabby, and movements are slow. The patient tires easily and on this account gains a reputation of being lazy.

URINARY SYSTEM.—The urine may be neutral or alkaline, exceptionally acid; it is increased in amount, pale in color, and varies from 1,010 to 1,015 in specific gravity.

GENITAL SYSTEM.—The effects of this disease upon the genital system may be very marked. If severe infection occurs in early childhood, puberty may be delayed for several years. I have known girls of 20 years, who menstruated only two or three times a year, then chiefly in winter, and girls of 18 to 26 who had never menstruated.

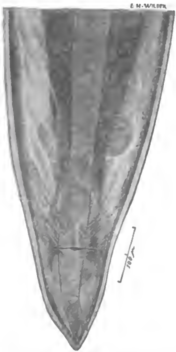


FIG. 9.—Ventral view of the tail of the female. Original.

FIG. 10.—Lateral view of the tail of the female. Original.

The menstrual retardation and irregularity are in fact among the most prominent and most common symptoms noticed, and there is no room for doubt that hookworm disease is one of the most common causes of menstrual disorders among the southern girls, especially in the cotton mills and in the open country. It is in fact so common among such girls that it should be considered in connection with every case of menstrual disturbance found among them.

Abortions and miscarriages are common; sterility and impotence are reported as frequent.

LETHALITY.

In connection with the lethality of hookworm disease it is important to note that this infection has both *direct* and *indirect* effects in the death rate. The Porto Rican Commission estimated that about 30 per cent of the deaths on the island were due to hookworm disease. We are not in a position to give exact data on this point for the United States. The view that this is a nonfatal disease is superlatively erroneous, but the more I study its effects the more I am persuaded that whatever may be the number of deaths *directly* due to hookworm infection, the *indirect* effects of the disease are equal to, perhaps greater than, the *direct* effects.

In tuberculosis, for instance, when good nourishment and fresh air are so important, the diseased condition of the intestinal canal and the lowered condition of the blood must have very serious results. Heiser's estimate that hookworm disease doubles the chances for death in cases of tuberculosis seems entirely reasonable.

Garrison's recent work in Bilibid prison (Manila) is very interesting in this connection. When the Americans took charge the death rate was 234; institution of sanitary reform brought this down to about 75; here it remained, until it was discovered that 52 per cent of the prisoners had hookworms; systematic treatment was instituted against intestinal parasites, and the death rate fell to 13.5. It is too early as yet to determine what proportion of this reduction is due directly to the freedom from hookworms and what proportion to other factors.

EFFECTS IN LATER LIFE.

A person who is especially familiar with hookworm disease can frequently notice in adults quite clear evidence (in the color and quality of the skin, growth of beard, form and carriage of the shoulders, stature, hair, etc.) that a given person has had hookworm disease, probably in his youth.

DURATION.

In case no reinfection occurs, a hookworm patient may retain part of his infection for at least six years and seven months, probably for about ten to twelve years. The present evidence, though incomplete, indicates that he will perhaps outgrow his infection in about ten to twelve years. One case has recently been brought to my attention in which, from present evidence, the infection seems to have existed for eleven years, although the patient was apparently removed from all chance of reinfection.

DISTRIBUTION AND FREQUENCY.

Geographic.—Hookworm disease in man is a tropical and subtropical malady. In the United States, the Ohio and Potomac rivers

constitute, roughly speaking, the northern limit of endemic infection. Cases do, however, occur farther north, but such instances are rare in comparison with cases in the South, and probably most instances of infection recognized in the North are either imported from some other part of the country, or from some other country, or they are instances in which infection has occurred in mines.

RACIAL.—The indications at present are that the infection is more common, but with less severe effects, in the negroes than in the whites.

SEX.—Authors quite generally view hookworm disease as more common in males than in females, but my experience is the reverse. Recently, of 1,725 cases and suspects I have examined, 922 persons (or 53.4 per cent) were males and 803 persons (or 46.5 per cent) were females. This does not mean, however, that the malady is more common in males than in females, but simply that I examined more male cases than female cases, and if proportions are based upon the total number of persons seen the results are different. For instance, in one series of 440 cases, 242 were males and 198 females; but the 242 males represented 15.2 per cent of 1,583 males examined, while the 198 females represented 16.1 per cent of 1,225 females examined; thus while more male cases were actually found, the percentage of infection was greater among the females. The relative frequency in the two sexes will doubtless vary according to local conditions; for instance, in mining localities a higher percentage of infection may be expected among the males than among the females.

AGE.—Likewise authors assume that hookworm disease is more common in adults than in the young. This might easily be the case in a northern mining district, but is distinctly at variance with my experience in the United States, as is shown by the following tables:

Over 20 years old	272	suspects=18.5 per cent of 1,470
Between 16 and 20 years old	338	suspects=22.9 per cent of 1,470
Under 16 years old	860	suspects=58.5 per cent of 1,470
Total	1,470	

The following table is even more exact as to the point at issue:

	Males.			Females.			Total.[a]		
	Suspects.	Hands seen.	Per cent.	Suspects.	Hands seen.	Per cent.	Suspects.	Hands seen.	Per cent.
Over 20 years	47	809	5.8	60	459	13.0	107	1,268	8.4
16 to 20 years	51	246	20.7	58	319	18.1	109	565	19.2
Under 16 years	133	452	29.4	63	336	18.7	226	828	27.2
Total[a]	242	1,583	15.2	198	1,225	16.1	[b]1,026	[b]8,092	12.6

[a] In the foregoing table, the totals do not all agree with the sum of the respective columns, as some of the totals contain additional cases.

[b] 1,014 suspects in 8,069 hands of 59 mills, plus 12 cases in 23 mill hands examined microscopically in Augusta.

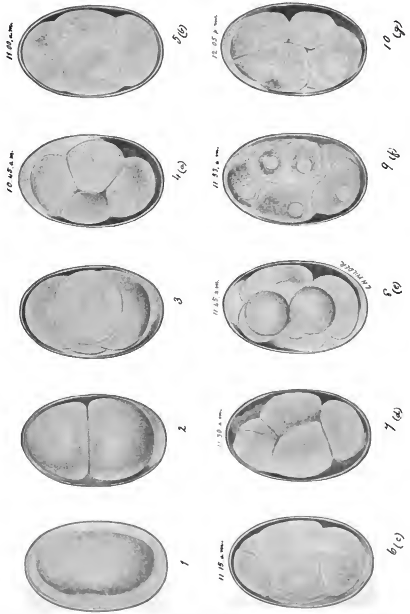


FIG. 11.—Hookworm eggs, enormously enlarged, in different stages of development. The series *a–g* is drawn from one and the same specimen, at different intervals from 10.45 a. m. to 12.05 p. m., and shows how rapidly the development takes place. Original.

Fig. 12.

Fig. 13.

FIG. 12.—Greatly enlarged view of a hookworm shortly after it has hatched from the egg. Original.

FIG. 13.—Figure of a worm about seven days old. This is the so-called "encysted stage" and is the stage which enters man. Original.

As to soil.—Other things (especially density of population and climate) being equal, hookworm disease is much more prevalent in areas with a porous soil (as a sandy soil) than in localities with a clay soil. For instance, in the clay belt which runs southward through the Carolinas, then westward through Georgia and Alabama, the infection is much less severe and less common than in the sandy areas toward the coast and in the mountain areas toward the west and north. It is easily conceivable, however, that special conditions as to density of population, shade, etc., might result in different results in a given area.

City and rural districts.—The average person who visits the South, visits a few cities such as Atlanta, New Orleans, etc. To him, unless he is an expert on hookworm disease, the statement that this is an exceedingly common disease might easily seem absurd. But no one really knows the South unless he knows the rural districts in addition to the cities.

In a city with a good sewer system hookworm disease will not spread (except for cases due to such factors as pollution of lots and alleys), hence cases need not be expected to be common.

In a village with a privy system the disease will spread in proportion to the number and style of privies and to the carelessness exercised in keeping the toilets.

It is especially in the rural districts, or among persons who have recently come from rural districts, that hookworm disease is found. This is due to the ignorance and carelessness exercised in the rural areas in respect to sanitary matters. In a tropical or subtropical region where over 50 per cent of the farmhouses and, according to estimate by competent educators, at least 30 per cent of the country schools, and even a much higher percentage of the country churches, have no toilet closet of any kind, hookworm disease has an excellent chance to spread, and in our rural South it is one of the most common of the diseases. My present estimate is that not less than 30 per cent of the rural inhabitants of our Southern States have hookworm infection. In some restricted localities fully 90 per cent have the infection.

Social condition.—While it is chiefly among persons in poorer financial condition, who live in insanitary surroundings, that we find this disease, hookworm patients are found also among the financially better classes and among the better educated, though the infections among the latter are usually less severe as well as less common.

In schools and colleges.—Colleges are known in which over 30 per cent of the students show infection on microscopic examination. Country schools are known in which 35 to 95 per cent of the pupils harbor hookworms.

In view of the effects which hookworms have on the nervous system, including inhibiting effects on mental processes, this disease must be viewed as important in connection with the subject of education, more especially in the rural districts.

In United States Army.—Several members of the Medical Corps of the Army have recently published very instructive statistics in regard to hookworm infection found among soldiers who were sufficiently able-bodied to pass the physical examination for enlistment into the army.

Dr. J. F. Siler reports 85 per cent of infection in 140 Southern recruits examined at Fort Slocum, N. Y.

Dr. W. P. Chamberlain examined 147 apparently healthy soldiers at Jackson Barracks, La. Of these, 43 were Southern-bred recruits received at Fort Slocum, and 29 men (or 67 per cent) showed infection. Among 57 Southern-bred soldiers who were in their first enlistment, infection was found among 31 men (or 54 per cent). Among 33 Southern-bred soldiers of more than three years' service infection was found in 4 men (or 11 per cent). Among 14 soldiers who had lived little or not at all in the South no infection was found.

Light infections in apparently healthy people, as found among soldiers and among college students, are of particular significance in connection with spreading the disease, as these persons act as "carriers" of the infection.

DIAGNOSIS.

There are three methods of diagnosing hookworm disease—namely, by microscopic examination of the fecal material to find the eggs (p. 19); by judging the symptoms (p. 26); and by experimental treatment and finding the expelled worms in the stools (p. 26).

Microscopic examination of feces.—It is rare that the adult worms are seen in the discharges except during treatment, but the stools of hookworm cases contain the characteristic eggs (fig. 11) of the parasite, and by finding these eggs a positive diagnosis can easily be made. The Southern state boards of health and the Hygienic Laboratory of the United States Public Health and Marine-Hospital Service are making this examination free of charge.

Ordinary technique: For ordinary purposes the following technique is sufficient: Patients are instructed to furnish about half an ounce of their fresh fecal material. A small portion of this is taken up on the flat end of a toothpick (using a separate toothpick for each specimen) and smeared on a slide in a drop of water (personally I prefer the 2 by 3 inch rather than the 1 by 3 inch slide; and in hot weather or when the feces are especially offensive, trikresol is better than water); the smear should be uniform and not too thick; no stain-

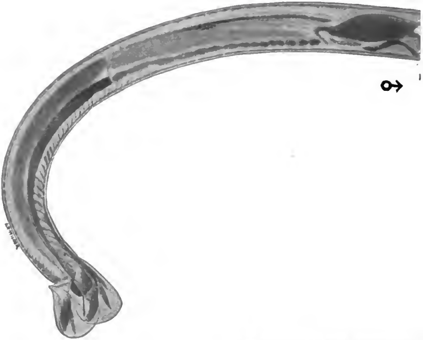


FIG. 14.—Greatly enlarged lateral view of the male

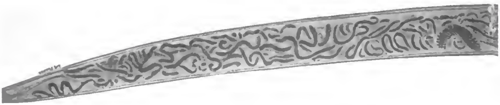
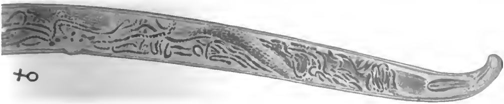


FIG. 15.—Greatly enlarged lateral view of the female

(♂) hookworm (*Necator americanus*). Original.



(♀) hookworm (*Necator americanus*). Original.

ing or drying is necessary; a cover glass (1 inch square is a good size) is placed over the smear, fluid is added under the cover if necessary or drained off in case too much is present, and the preparation is examined under an 8-millimeter (or one-third inch) objective. A mechanical stage is unnecessary. The manipulation of the slide is rendered easier if it is held lengthwise (if a 1 by 3 slide is used) rather than otherwise. In heavy infections the eggs will usually be found on the first slide, but at least ten such preparations should be examined before a negative opinion is expressed. It takes about thirty to sixty minutes to examine ten such slides properly.

FIG. 16.—Section through the skin of a dog within two hours after it has been infected with the Old World Hookworm.[a] Greatly enlarged.

Usually eggs will be found in fresh feces in the 4 to 8 cell stage (fig. 11). If in perfectly fresh specimens eggs are found in the 32-cell stage there is a chance that another parasite (*Trichostrongylus*) is present.

[a] FIGS. 16-23 have been prepared from a series of slides of the "Old World Hookworm," presented to the United States Public Health and Marine-Hospital Service by Prof. Arthur Looss, of Cairo, Egypt. They show how the worm wanders from the skin to the intestines. This discovery by Professor Looss represents one of the most important discoveries in modern medical zoology.

If free embryos are present in the fresh feces the probability is that the Cochin China worm (*Strongyloides stercoralis*) is present.

The mouth cavity of the hookworm embryo is about as long as the diameter of the embryo at the posterior end of mouth cavity; in the embryo of *Strongyloides* the mouth cavity is only about half as long as the diameter of the embryo at the posterior end of the mouth cavity.

If pressure is exerted on the slide, the outer covering of *Ascaris* eggs may rupture, and the beginner might possibly confuse these with hookworm eggs. The beginner in this work may also be confused by various vegetable cells found in the specimen, which he mistakes for eggs, or by plant hairs, which he mistakes for embryos.

FIG. 17.—The same cut transversely. Some larvæ are seen in the lymph capillaries.

Strawberry hairs, especially, are mistaken for hookworms by persons not familiar with this class of work.

Bass's technique: Experience shows that in some light infections the eggs are so few as to be easily overlooked. Bass has recently suggested a very novel method of concentrating these ova, by using salt solution, or, preferably, calcium chlorid, in a solution slightly heavier in specific gravity than are the eggs.

Bass (1909, June 15) describes his method as follows:

The specific gravity of fresh uncinaria eggs is between 1,050 and 1,100. When they grow old this is increased in many specimens.

A quantity of feces is well diluted with water, 1 in 10, and strained through gauze to get rid of coarse particles. This is centrifugalized, the fluid poured off, the cen-

trifuge tube refilled and centrifugalized again until all the diluted feces have been used. The precipitate is rewashed several times with water as long as anything can be washed out. To know just how long to continue the centrifugalization is the secret of success. One must learn just what is the proper time for his centrifuge. It should be carried out at high speed and just long enough to throw the eggs to the bottom. Too long centrifugalization defeats the purpose. With a centrifuge running 3,500 revolutions per minute, ten seconds at first, when there is much matter, and then four to five seconds is usually the proper time. The centrifuge must be steady. This gets rid of most very small things, those having flat, rough surfaces and those having a specific gravity about that of water. Now the precipitate should be washed as before, using calcium chlorid solution of a specific gravity up to 1,050. (Calcium chlorid is preferable to other salts because of its hygroscopic property. This was suggested by Prof. A. L. Metz.) This disposes of everything having a specific gravity below 1,050, and the precipitate may now be examined. There frequently remains a considerable amount of material, much of which is considerably heavier than the eggs and of such a character that it interferes much with their recognition. This

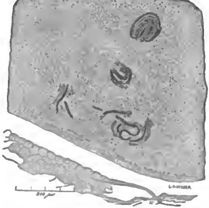


FIG. 18.—Section showing larvæ in axillary gland.

material may be removed by centrifugalizing with a solution sufficiently heavier than the eggs. A solution with a specific gravity of 1,250 is very satisfactory. In such a solution the eggs go to the top and other material below. With an appropriate pipette one may remove a few drops from the surface and examine, or, what is still better, pour off some of the top fluid containing eggs, dilute with water sufficiently to bring the specific gravity below 1,050 and centrifuge again. The precipitate will now contain most of the eggs contained in the original amount of feces and may all be put on one slide and examined. One such slide contains as many eggs as could be found in several hundred ordinary slide preparations of feces.

Pepper's technique: Dr. William Pepper (1908, March) has developed still another technique. The fecal material is much diluted with water and then centrifugalized in small quantities. The washing is frequently repeated, and when after each centrifugalization the supernatant dirty water is thrown away and fresh water added, the whole is then shaken up and again placed in the centrifuge. In this way the bacteria, free coloring matter, light vegetable matter, etc., are soon gotten rid of and only the heavier particles, including any

ova that may be present, will remain. After about six repetitions of this eliminative washing the sediment can be easily and satisfactorily examined under the low power of the microscope. There is then left no obscuring cloud of bacteria or fine granular débris, but instead each ovum stands out sharp and clear.

Pepper then goes on to say:

In endeavoring to remove some ova from a slide under the microscope prepared in this manner, by touching the egg with a very finely drawn out glass tube and thus causing it to be carried up into the tube by capillary attraction, it was found impossible with the ova of *Uncinaria*, the eggs having stuck to the glass. I have thus frequently transferred from one slide to another the ova of *Ascaris lumbricoides*, of *Tri-*

FIG. 19.—Section showing larvæ in lymphatics.

churis trichiura, and of *Tænia saginata*, and have never seen them adhere at all to the slide. A rather peculiar fact to be noticed in this connection is that the ova of the *Uncinaria*, although sticking closely to the glass slide, do not seem to adhere to any of the many other constituents of the stool. When a drop of this washed sedimented feces is allowed to stand on a slide for a few minutes and then gently immersed in water and examined microscopically, the eggs are found adhering to the slide while all else has been washed away. If additional drops are placed on the slide and washed off, the slide becomes thickly studded with the eggs. A ring of asphalt may be used to keep the drop when placed on the slide in bounds, and also serves to support a cover glass. Both the Old World and the New World variety act in the same way. The ova at all stages in their development behave in the same manner, even including those in which a living embryo could be seen moving within the egg. Ova were also seen to develop up to this stage while mounted in this way in water and under a cover glass, but were not observed to progress further. For demonstration purposes this method has proved very useful.

DIAGNOSIS BY SYMPTOMS.—The recognition of well-marked cases on basis of symptoms presents very little difficulty to one who is thoroughly familiar with this disease, but in general for every case so recognized, one to several cases will be in doubt or will entirely escape the clinician who may depend entirely on symptomatology.

Given a patient in the area of infection, with dry hair, dry skin, dilated pupil or with unusual tendency to dilatation, with tenderness in the epigastric region, continuing toward the right but with a tendency to disappear toward the left, with winged shoulder blades, shoulders sloping down and forward, slow of speech, tallow-like skin, poorly developed in general, anemia, scant pubic and axillary hair, a delayed type of menstruation, and a history of ground itch, espe-

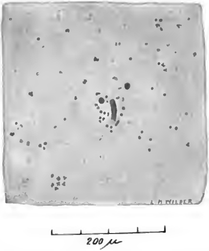


FIG. 20.—Section through the heart, showing a larva in the center of the illustration.

cially if several such persons exist in the same family, and diagnosis is practically positive.

DIAGNOSIS BY EXPERIMENTAL TREATMENT.—As the state boards of health are making diagnoses free of charge, there is little if any reason for not having a microscopic examination made. At the same time the practical difficulty must be frequently faced that many rural people who have no objection to a microscopic examination of their sputum and urine do object very decidedly to furnishing samples of their stools. This may appear incomprehensible, but it is a factor which must be squarely faced. Again, in remote rural regions it is often impracticable to make several trips to the house to obtain a stool, and it is often impossible to induce the patient's family to take the trouble of sending a stool to the physician. In such cases almost the only plan to follow is to institute an experimental treatment and see if hookworms are passed.

TREATMENT.

The fundamental principle underlying the treatment of hookworm disease is the same as that which underlies the treatment of all other zooparasitic diseases, namely, first treat the parasite, not the patient. After the parasite is treated, attention may be directed to treating the patient.

Although hookworm disease may occur in persons in any walk of life, it is particularly among the poorer classes that it is found, and the average hookworm patient (children excepted, to a certain extent) can not afford to lose several days' wages to undergo treatment. It is therefore frequently expedient to conduct the treatment Saturday evening and Sunday morning. It will often be found difficult to arouse the interest of a community in regard to the presence of hook-

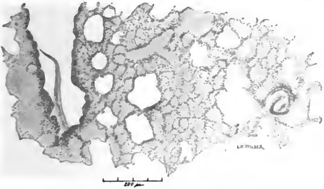


FIG. 21.—Section through the lungs, showing two larvæ.

worm disease and the need of treatment. This can frequently be done, however, if it is borne in mind that the resulting anemia is, in common with other anemias, a frequent cause of amenorrhea.

WARNING.—Recalling that primarily we are to treat the parasite, not the patient, it should be remembered that if too great a quantity of thymol is absorbed by the patient, alarming symptoms and even death may occur. Accordingly, the patient and the patient's family should be carefully warned not to permit the patient under any circumstances to have on the Sunday during which the treatment is given any food or drink containing alcohol, fats, or oil. Patent medicines should be mentioned in particular, because of the alcohol many of them contain, and even milk and butter should be forbidden. I know of one case of serious thymol poisoning which followed promptly after the patient took a copious drink of milk the day thymol was taken.

PRELIMINARY TREATMENT.—On Saturday evening give a dose of Epsom salts. The reason is this: The hookworms are surrounded by more or less mucus and partially digested food. Unless this is

removed, the thymol may not reach the parasites, but may reach the patient, and this is contrary to what is desired, as the thymol is intended for the parasite, not the patient.

THYMOL TREATMENT ON SUNDAY.—(1) *Position of patient:* Instruct the patient to lie on his right side immediately before taking the drug and to remain in that position for at least half an hour after. The reason for this is that many of these patients have enlarged stomachs, and if they lie on their right side, the drug has the benefit of gravity in passing rapidly from the stomach to the intestine; but if any other position is assumed, the drug may remain in the dilated cardiac portion of the stomach for some hours and result in considerable complaint on the part of the patient and delay of the drug

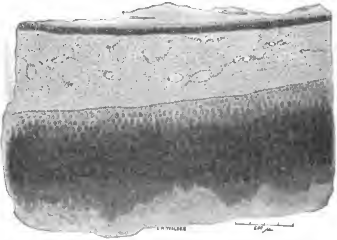


FIG. 22.—Section through the trachea, showing larvæ wandering free on the surface.

in reaching the worms. It is best for the patient to remain in bed until after 10 o'clock (see next paragraph).

(2) *Time of dosage:* The time of giving and size of dose may be arranged on either of two plans, depending on existing conditions.

(a) The plan usually followed is: At 6 a. m., one-half of the total dose of thymol; at 8 a. m., one-half of the total dose of thymol; at 10[a] a. m., Epsom salts (never castor oil).

(b) If the case is an especially severe one, or if the patient has, upon the first Sunday's treatment, complained of burning or other effects of thymol, the following plan is adopted: At 6 a. m., one-third of the total dose of thymol; at 7 a. m., one-third of the total dose of thymol; at 8 a. m., one-third of the total dose of thymol

[a] Some physicians prefer to allow a longer time (six to eight hours) to elapse between the last dose of thymol and the Epsom salts. If this plan is followed, it is wise to keep the patient under rather close observation.

(if unpleasant symptoms, as a sensation of severe burning in the stomach, have appeared this third dose should be omitted); at 10[a] a. m., Epsom salts (never castor oil).

(3) *Food:* No food is allowed until after the 10 o'clock dose of Epsom salts, but the patient is permitted to take a glass or so of water after the thymol, if he desires.

(4) *Thymol:* Finely powdered thymol in capsules, preferably in 5-grain capsules, should be used. A recently proposed modification in the dispensing of the drug promises excellent results; this is to powder finely the thymol with an equal amount of sugar of milk and to use the flat capsule (cachet) instead of the cylindrical capsule. By this method, the packing of the thymol, sometimes observed when the cylindrical capsule is used, is avoided.

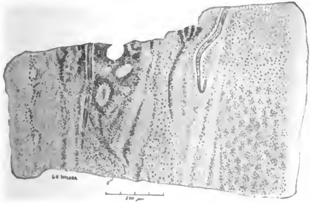


FIG. 23.—Section through the larynx, showing two larvæ.

(5) *General rule as to age:* In the table of dosage given in the next paragraph, the maximum dose per day to be adopted as a routine is given for various age groups. In determining the dose, however, the rule should be followed of taking the apparent rather than the real age and of not hesitating to cut down the dose even lower in case of unusually severe cardiac symptoms or other unfavorable conditions. Thus for a boy 16 years old, who appears to be only 12 years old, or in whom the anemia is especially marked, resulting in severe cardiac symptoms, the quantity of thymol should be reduced to the 12 or even the 8-year dose. Some authors give the impression that it is useless to give thymol for this disease unless the full dose is administered. This view is not in harmony with my experience.

[a] Some physicians prefer to allow a longer time (six to eight hours) to elapse between the last dose of thymol and the Epsom salts. If this plan is followed, it is wise to keep the patient under rather close observation.

(6) *Size of dose:* The following doses represent the maximum[a] amount to be used during one day's treatment for the age groups in question. This is practically the same table that the Porto Rican Commission has been using:

	Grains.
Under 5 years old	$7\frac{1}{2}$
From 5 to 9 years old	15
From 10 to 14 years old	30
From 15 to 19 years old	45
From 20 to 59 years old	60
Above 60 years old	30 to 45

Total dose, to be divided as indicated in paragraph (2).

FIG. 24.—An old privy, showing how soil pollution occurs.

REPETITION OF TREATMENT.—The foregoing treatment is repeated once a week, preliminary treatment Saturday evening and thymol on Sunday morning, until the patient is discharged.

DURATION OF TREATMENT.—To recognize whether the parasites are all expelled, and therefore to determine when to end the thymol treatment, either of two plans may be adopted, namely:

[a] Some physicians use larger doses, but the doses here given seem to be large enough.

(a) *Microscopic examination:* On Saturday morning make 10 microscopic preparations of a fresh stool, or test the stool by the Bass method (see p. 23). If eggs are still present, repeat the treatment; if eggs are not found, discontinue the thymol. It takes about thirty to sixty minutes to make this examination of 10 slides thoroughly.

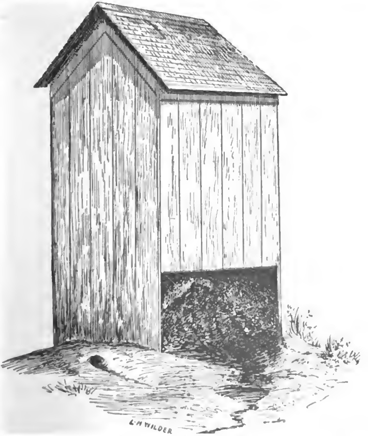


FIG. 25.—Rear view of a "surface privy, open in back," showing how soil pollution occurs. This is the most common style of privy in use in the South.

(b) *Cheese-cloth method:* A much easier way of recognizing the completion of the treatment, and for practical results nearly as satisfactory as the microscopic examination, is the following: Instruct the patient to wash all of his stools Sunday and Monday through a cheese cloth and to keep the cheese cloth moist and bring it to the office on Monday. While the fecal material will wash through, the worms will be retained in the cloth. Continue treatment as long as worms are found in the cheese cloth.

Other treatment.—If desired, iron may be administered on the days on which the thymol is not taken. It is a good plan, however, not to give iron during the first week, for it is quite important to convince the patient that the thymol treatment is the one which is really accomplishing the lasting good. If the drug is taken Sunday, the patient is likely to begin to feel some benefit by Wednesday or

Fig. 26.—A floor privy, pail system, closed in back.

Thursday; his family is likely to notice it on Thursday or Friday. If iron is given during the first week the conclusion may possibly be drawn by the patient that it is really the iron which is causing the improvement, and he may discontinue the thymol. Of the two, the thymol is, of course, the far more important, for it reaches the parasite, while the iron reaches only the patient.

PREVENTION.

The life cycle of the hookworm, as described on page 37, makes it clear that hookworm disease is spread by soil pollution. As the eggs escape from the infected persons in the fecal material, it is clear that if this is properly disposed of, the infection will not spread.

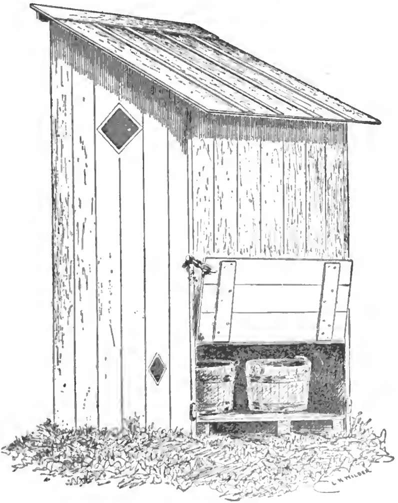


Fig. 27.—View of a floor privy, tub system.

Night soil should be burned, or boiled, or fermented, or it should be buried not less than 300 feet away and down hill from the water supply (well, spring, etc.). It should not be used as fertilizer unless it is first boiled or fermented, as in a septic tank. Soil pollution should be made a crime, punishable by fine or imprisonment.

The public should be warned to guard against ground itch, as this is so commonly the beginning of hookworm disease (or ground itch anemia). It is particularly in warm moist weather, or in moist places during warm weather, that ground itch is contracted. Accordingly, the infecting stage of hookworm disease is usually more common in the summer and early fall than during the winter and early spring.

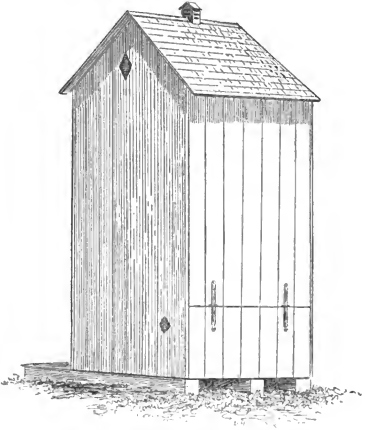


FIG. 28.—View of a floor privy, tub system, closed in back.

The existing infection in the South is easily understood if the sanitary conditions in villages and especially in the open country are studied. The usual style of privy found is shown in figure 25. With a closet of that type the spread of hookworm disease and of typhoid fever must be expected. Figure 24 shows the condition of the privy on too many farms. About 57 per cent of 3,369 farmhouses I have tabulated for six of the Southern States are even worse off than that, for they had no closet at all. Of 1,770 farmhouses occupied by whites 35.87 per cent had no privy, and of 1,599 farm-

houses occupied by negroes 80.42 per cent were without privy. Thus, a theoretical maximum of soil pollution was occurring around 57 per cent of the farmhouses examined, and as a soil polluter the negro is far in excess of the white. In a region where negroes, showing (p. 15) a relative immunity toward hookworm disease, bear a ratio to the white of 833 to 1,000 as inhabitants and 8,042 to 3,587

FIG. 29.—View of a floor privy, box system, closed in back. This system is somewhat cumbersome to work, and is not so likely to be water-tight as is the pail or tub system; further, also, repairs are more expensive and more difficult, if the closets are not made properly.

as soil polluters, their effect on the general health of the population must of necessity be marked.

To prevent hookworm disease it is necessary to prevent soil pollution. In rural districts this should be done by a compulsory privy law. In towns, it is best to license the privies at $3 to $5 per year and to use the money thus collected in removing the night soil and furnishing the tub and disinfectant.

Figures 27 and 28 show a toilet closet designed to prevent soil pollution. The following are the chief features of this outhouse: The floor extends under the seat and supports tubs or pails; the portion holding the tubs is closed in back by a door, hinged as shown in the figures; it is also ventilated at the sides, the ventilators being wire screened to keep out the flies; wire-screened ventilators are also located higher up on the sides and above the front door; the seats should be provided with hinged covers.

The tub should have a thin layer (say quarter of an inch) of sand or other dirt on the bottom and should be filled about one-fourth full with some fluid disinfectant, such as a 5 per cent solution of the compound solution of cresol (U. S. P.). In case of special necessity for economy, the tub may be filled about one-fourth full with water and a cupful of kerosene poured on it to keep insects away; in this event, however, care must be taken against throwing burning matches, etc., into the tub. The tub should be sufficiently deep and its floor sufficiently below the seat to avoid danger from splashing, but the top of the tub should come quite close to the seat.

If the South would adopt and enforce compulsory privy laws and use sanitary privies there would be a great reduction and gradual eradication of hookworm disease, and at the same time a great reduction in typhoid fever, amebic dysentery, and other soil-pollution diseases.

For a more detailed discussion of the sanitary privy see Public Health Bulletin 37.

According to the statistics given in the last census, the average typhoid death rate[a] for the entire country was 46.5 deaths per 100,000 inhabitants, and the average negro population 11.6 per cent.

Fifteen States, which stand above the average in negro population, average 34.34 per cent negroes and 72.70 typhoid deaths per 100,000 inhabitants.

Seventeen States, which have at least 1 per cent but not over 10 per cent negro population, average 2.48 per cent negroes, and 39.25 typhoid deaths per 100,000 inhabitants.

Eighteen States, which have less than 1 per cent negro population, average 0.42 per cent negroes and 25.51 typhoid deaths per 100,000 inhabitants.

Thus not only hookworm disease but typhoid fever also follows the mediæval sanitary conditions which have followed the negro. And (p. 34) 35.8 per cent of the rural whites I have tabulated are

[a] These statistics are, of course, not complete, but as they are gathered by the same method in all the states of the nonregistration area, it is fair to use them in a comparative statement for nonregistration districts; if any injustice exists in this comparison, it is an injustice to the registration States.

living under sanitary conditions not better than those of 80.4 per cent of the rural negroes.

In some sections of the United States the sanitary conditions surrounding many rural schools and rural churches are scarcely other than mediæval. Because of an absence of a privy, soil pollution at these places may spread disease to the pupils and the infection may be carried to uninfected homes. An immediate and radical reform in the sanitary surroundings of such schools and churches is urgently needed.

LIFE HISTORY OF THE HOOKWORM.

The adult hookworms live in the small intestine, occasionally in the stomach. They mate in the bowels, and the females deposit numerous eggs (fig. 11). The eggs do not, however, undergo full development until they are discharged with the fecal material from the host. Thus, every individual hookworm found in the intestine represents infection with a separate germ.

Free life.—After a short time (eight hours to several days), the period varying according to conditions of heat and moisture, a tiny embryo (fig. 12) develops in each egg. This embryo breaks through the eggshell and feeds on the ground or in the night soil. In the course of two days or so the embryo sheds its skin but continues to feed. After about a week the worm sheds its skin again, but continues to live inside of its discarded skin, and it no longer takes any food. During this development, the rapidity of which may vary according to circumstances, the worm undergoes a growth in addition to certain changes in structure. The worm which lives in its second cast-off skin (fig. 13) represents the infecting stage which enters man and is sometimes called the "encysted stage." It may live in this condition for five months, perhaps longer.

Mode of infection.—Infection may occur in two different ways, namely, per mouth or per skin.

Mouth infection: Formerly, infection by mouth was supposed to be the only method by which the worms entered the human body. Then, when the method of skin infection became known, opinion went to an extreme and there was a tendency to ignore or minimize the mouth infection. Opinion is now moving back again in the other direction and indications are accumulating to support the view that infection by mouth is by no means rare or exceptional.

Skin infection: If the infecting stage (fig. 13) gets upon the skin, either of persons who go barefooted or who handle infected dirt, the worm bores its way into the pores, as into hair follicles, and escapes from its surrounding sheath-like skin. It then starts on its passage through the body (figs. 16–23). It may enter the blood, pass through

the heart (fig. 20), filter out in the lungs (fig. 21), crawl up the trachea (fig. 22), down the esophagus, through the stomach, and find its way to the small intestine. In laboratory experiments on animals, the worms may be found in the intestine eight to fourteen days (possibly earlier) after the skin infection has been practiced. Arriving in the intestine, the worm sheds its skin two more times, becomes adult and mates, and Looss has proved in the case of the Old World hookworm that eggs may be found in the stools seventy-one days after infection.

Claude Smith found eggs in the feces six and one-half weeks and seven weeks after experimental skin infection on two persons with the American parasite.

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STUDIES UPON LEPROSY

VII. A STATISTICAL STUDY OF AN ENDEMIC FOCUS OF LEPROSY

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A PALLIATIVE TREATMENT FOR LEPROUS RHINITIS

BY

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A STATISTICAL STUDY OF AN ENDEMIC FOCUS OF LEPROSY.

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INTRODUCTION.

Much has been written about the endemic focus of leprosy which has existed in the Hawaiian Islands for about half a century, but until the completion of the thoroughgoing analysis of the official records of the Hawaiian Territorial Board of Health which appears in the following pages, the rich epidemiological data upon lepra yielded by this focus of the disease have never received the careful treatment which they deserve.

The computations of this report have been checked and rechecked and are, we believe, as accurate as is possible within the limitation prescribed by the basic data and the percentage of error inherent in such work.

Table I.—*Number of new cases of leprosy, apprehended by years and by five-year periods in the Territory of Hawaii.*

Year.	New cases.		Year.	New cases.	
	By years.	By five-year periods.		By years.	By five-year periods.
1881	195		1896	147	
1882	70		1897	126	
1883	301	777	1898	80	513
1884	108		1899	58	
1885	103		1900	102	
1886	42		1901	86	
1887	220		1902	74	
1888	558	1,310	1903	115	459
1889	306		1904	86	
1890	184		1905	98	
1891	142		1906	56	
1892	109		1907	95	177
1893	210	704	1908	26	
1894	137				
1895	106		Total	3,940	3,940

The most striking thing about this table is the surprising variation in the number of lepers segregated each year. It is not possible to understand the variation in the annual number of lepers segregated without some knowledge of the political history of the Territory.

From the beginning of our table until 1893 the form of government was monarchical, the native ruler being more or less under the influence of foreign advisers. The sudden increase in lepers apprehended in 1887, 1888, and 1889 finds its explanation in the fact that a new constitution was forced upon the native ruler and a reorganization

of the personnel of the board of health was insisted upon by the foreigners then in power. In 1893 a revolution resulted in the formation of a republic, which was followed by a provisional government, which in turn gave way to American rule when the islands were annexed by the United States in 1898. It will be noted that the revolution in 1893 was followed by an increase in the number of lepers apprehended.

Considering the number of lepers apprehended by five-year periods, we see that the period from 1886 to 1890 was the time of greatest activity. It is probable that some of the decrease in the following decade is due to the good work done during that period. Since 1900 it is probable that the decrease is apparent rather than real, and the dying out of the native Hawaiian race, which furnished the bulk of the lepers, is not the real cause of the decrease of the disease.

TABLE 2.—*Number of new cases of leprosy apprehended, by years and by five-year periods, in each island of the Territory of Hawaii.*

Year.	Oahu.	Hawaii.	Maui.	Kauai.	Molokai.	Year.	Oahu.	Hawaii.	Maui.	Kauai.	Molokai.
1881	28	34	94	12	26	1896	39	69	18	12	9
1882	24	18	9	6	13	1897	38	33	21	19	15
1883	83	82	85	33	18	1898	25	19	24	7	5
1884	42	28	24	3	11	1899	27	7	14	10	0
1885	9	24	24	15	31	1900	29	53	16	4	0
	186	186	236	69	99		158	181	93	52	29
1886	10	6	8	1	17	1901	34	20	21	8	3
1887	56	36	90	14	24	1902	43	7	12	11	1
1888	214	171	108	58	7	1903	59	38	5	11	2
1889	118	103	71	5	9	1904	38	11	33	2	2
1890	83	38	36	19	8	1905	57	24	12	4	1
	481	354	313	97	65		231	100	83	36	9
1891	50	42	27	12	11	1906	25	18	7	6	0
1892	25	37	37	9	1	1907	35	20	20	7	13
1893	86	47	25	44	8	1908	11	9	0	6	0
1894	53	28	13	29	14						
1895	50	9	32	12	3		71	47	27	19	13
	264	163	134	106	37	Grand total.	1,391	1,031	886	379	252

In one case no island was given.
NOTE.—The small island of Lanai is included with Maui. The small island of Nithau is included with Kauai.

The Territory of Hawaii, for our purposes, consists of five islands, which constitute the political subdivisions of the Territory. These islands are Oahu (area 600 square miles, population 58,504); Hawaii (area 4,015 square miles, population 46,843); Maui (area 932 square miles, population 25,416); Kauai (area 641 square miles, population 20,734); Molokai (area 261 square miles, population 2,504).

This table shows that the island of Oahu yields the majority of the cases of leprosy in the Territory; Hawaii, Maui, Kauai, and Molokai following in the order named. If we compare the number of lepers from each island with the *gross* population of the respective islands, we see that they are in direct proportion. As, however, the majority of the lepers come from the native race, it is necessary to compare the

native population by islands with the number of native lepers from each island. When this is done we find that the cases of leprosy are in direct proportion to the *native* population.

Taking the mean number of lepers per year for the period 1896–1905 for each island and the native population of each island for the census year 1900, which would be in the middle of the decade from which we compute our mean lepers per year, we find that on the island of Oahu the morbidity of leprosy, among the native race, was 21.2 per 10,000; on the island of Hawaii, 25.1 per 10,000; on the island of Maui, 21.7 per 10,000; on the island of Kauai, 23.8 per 10,000; on the island of Molokai, 18.6 per 10,000.

The analysis of the above figures shows that, arranging the islands in order of the native population, they are Oahu, Hawaii, Maui, Kauai, and Molokai, while, if we arrange them in the order of the morbidity of leprosy among the native population, the order is Hawaii, Kauai, Maui, Oahu, and Molokai. The amount of leprosy in the Territory of Hawaii is known to be large, but when reduced to the conventional form of expression a morbidity of 25.1 per 10,000 of the native population on the island of Hawaii is certainly extraordinary.

The island of Oahu yields the greatest number of lepers per year, but the disease seems to be more prevalent among the native race on the islands of Hawaii, Kauai, and Maui. As a corollary to this we find that the occurrence of leprosy in the non-Hawaiian portion of the population is greatest on the island of Oahu, which contains approximately half of the Caucasian population of the Territory. We see from this that leprosy in the Territory of Hawaii is not confined to the remote districts.

Table 3.—*Number of new cases of leprosy apprehended by years and by five-year periods. from districts of the island of Oahu.*

Year.	Kona.	Koolaupoko.	Koolauloa.	Waialua.	Waianae.	Ewa.	Year.	Kona.	Koolaupoko.	Koolauloa.	Waialua.	Waianae.	Ewa.
1881	25	2	0	1	0	0	1896	31	3	1	1	0	3
1882	20	0	1	0	2	1	1897	30	6	1	0	0	1
1883	43	18	7	7	0	8	1898	19	3	1	1	0	1
1884	35	3	1	2	1	0	1899	21	2	0	0	3	0
1885	3	2	0	2	0	2	1900	23	1	1	2	0	2
	136	25	9	12	3	11		124	15	4	4	3	7
1886	7	0	0	0	2	1	1901	30	0	1	1	0	3
1887	37	0	2	9	4	4	1902	39	2	0	1	1	0
1888	155	12	8	11	9	17	1903	42	5	8	2	2	0
1889	87	3	11	13	3	1	1904	33	0	0	3	0	1
1890	74	2	3	1	2	1	1905	50	1	3	2	0	1
	360	17	24	34	20	24		194	8	12	9	3	5
1891	39	4	0	4	2	0	1906	21	2	1	0	0	1
1892	21	0	0	0	0	4	1907	25	0	7	3	0	0
1893	71	7	1	4	1	0	1908	7	1	1	2	0	0
1894	42	1	3	5	0	2							
1895	30	3	4	2	2	8		53	3	9	5	0	1
	203	15	8	15	5	14	Grand total	1,060	83	66	79	34	62

There were seven cases reported with no district given.

The island of Oahu, on which is situated the city of Honolulu, the capital of the Territory, as we have seen (Table 2), yields more lepers per year than any other island of the group. On examining Table 3 it will be found that the great majority of the cases of leprosy occurring on the island of Oahu come from the Kona district, which coincides with the boundaries of the city of Honolulu, under county government. During the last twenty-eight years the average annual yield of lepers from the city of Honolulu was 37.8.

Considering the occurrence of leprosy during the decade 1896–1905 in comparison with the population by the races, we get the following results:

Morbidity of leprosy per 10,000 of the total population of the city of Honolulu was 8.0.

Morbidity of leprosy per 10,000 of the native population of the city of Honolulu was 22.4.

Morbidity of leprosy per 10,000 of the non-Hawaiian population of the city of Honolulu was 2.1.

We see from this that even if we disregard the rest of the Territory, the occurrence and racial distribution of leprosy in the capital city presents a condition worthy of the most serious consideration and thoroughgoing efforts for the control of the disease.

TABLE 4.—*Number of new cases of leprosy apprehended by years and five-year periods from districts of the island of Hawaii.*

Year.	Hilo.	Kau.	Puna.	Kona.	Kohala.	Hamakua.	Year.	Hilo.	Kau.	Puna.	Kona.	Kohala.	Hamakua.
1881	6	3	0	10	14	0	1896	15	7	6	16	8	9
1882	5	3	1	3	6	0	1897	1	2	1	22	3	4
1883	27	9	3	13	20	9	1898	1	0	0	0	13	5
1884	10	2	2	4	2	8	1899	3	0	0	1	1	2
1885	3	2	3	7	7	2	1900	8	4	1	21	11	8
	51	19	9	37	49	19		28	13	8	60	36	28
1886	1	0	0	1	1	3	1901	5	3	2	9	0	1
1887	10	9	2	0	8	7	1902	2	0	4	0	0	1
1888	43	18	5	37	47	18	1903	5	4	1	9	12	7
1889	17	7	1	55	20	3	1904	1	1	1	7	1	0
1890	8	2	0	8	10	10	1905	11	0	1	0	8	4
	79	36	8	101	86	41		24	8	9	25	21	13
1891	9	1	10	9	2	9	1906	9	4	0	2	2	0
1892	7	9	2	5	13	1	1907	8	2	2	5	2	1
1893	8	4	6	12	12	4	1908	4	0	1	0	3	1
1894	5	4	1	7	9	2							
1895	0	0	0	3	6	0		21	6	3	7	7	2
	29	18	19	36	42	16	Grand total	232	100	56	266	241	119

There were seventeen cases reported with no districts given.

As we have seen from Table 2, the island of Hawaii has more lepers per thousand of the native population than any other island of the group. If we compute the morbidity of leprosy per 10,000 of the native population for each district of the island, we find Hilo, 22.0; Kau, 21.6; Puna, 18.4; Kona, 22.7; Kohala, 29.8; Hamakua, 35. It is evident from these figures that the amount of leprosy in the native race on the island of Hawaii is excessive. A morbidity for a

chronic infectious disease of 35 per 10,000 of the population certainly requires prompt and vigorous measures for the control of the disease.

TABLE 5.—*Number of new cases of leprosy apprehended by years and by five-year periods from districts of the island of Maui.*

Year.	Kona.	Wailuku.	Kahikinui.	Hana.	Koolau.	Hamakua.	Makawao.	Lanai.	Year.	Kona.	Wailuku.	Kahikinui.	Hana.	Koolau.	Hamakua.	Makawao.	Lanai.
1881	10	46	5	11	0	18	2	0	1896	2	8	3	3	0	0	1	1
1882	0	2	0	3	0	3	1	0	1897	3	4	3	8	3	0	0	0
1883	12	31	10	12	5	6	8	0	1898	2	15	1	1	1	1	3	0
1884	6	9	1	3	2	1	2	0	1899	1	10	1	0	0	0	1	1
1885	5	8	1	5	0	2	2	0	1900	1	4	3	4	4	0	0	0
	33	96	17	34	7	30	15	0		9	41	11	16	8	1	5	2
1886	0	3	2	2	0	1	0	0	1901	5	5	2	9	0	0	0	0
1887	19	38	6	16	5	3	3	0	1902	4	4	0	4	0	0	0	0
1888	16	49	10	17	0	1	15	0	1903	1	1	0	2	0	0	1	0
1889	13	30	5	12	3	2	6	0	1904	9	8	0	11	0	0	5	0
1890	2	23	0	6	0	0	5	0	1905	0	12	0	0	0	0	0	0
	50	143	23	53	8	7	29	0		19	30	2	26	0	0	6	0
1891	2	10	6	7	0	0	1	0	1906	3	3	0	0	0	0	0	1
1892	7	9	3	1	1	1	2	9	1907	1	7	1	5	2	0	4	0
1893	9	6	2	0	3	2	3	0	1908	0	0	0	0	0	0	0	0
1894	0	8	0	2	0	2	0	0									
1895	2	18	0	5	2	1	4	0		4	10	1	5	2	0	4	1
	20	51	11	15	6	6	10	9	Grand total	135	371	65	149	31	44	69	12

In eleven cases no districts were mentioned.

A computation of the morbidity of leprosy in the different districts on the island of Maui can only be made in the case of Wailuku district, owing to the fact that the United States census districts do not coincide with the geographical divisions used by the natives in locating their place of residence.

The morbidity of leprosy in the Wailuku district was 26.3.

TABLE 6.—*Number of new cases of leprosy apprehended by years and by five-year periods from districts of the island of Kauai.*

Year.	Kona.	Puna.	Koolau.	Halelela.	Napali.	Niihau.	Year.	Kona.	Puna.	Koolau.	Halelela.	Napali.	Niihau.
1881	9	0	0	2	0	0	1896	3	2	0	1	0	0
1882	3	1	0	2	0	0	1897	6	7	1	4	1	0
1883	22	8	1	2	0	0	1898	0	3	0	4	0	0
1884	1	0	0	2	0	0	1899	0	6	0	4	0	0
1885	6	6	1	2	0	0	1900	0	1	0	3	0	0
	41	15	2	10	0	0		9	19	1	19	1	0
1886	1	0	0	0	0	0	1901	4	2	0	1	0	1
1887	4	4	2	4	0	0	1902	3	3	2	2	0	1
1888	39	9	4	2	4	0	1903	0	8	0	3	0	0
1889	2	2	0	1	0	0	1904	0	2	0	0	0	0
1890	3	8	0	3	0	0	1905	3	1	0	0	0	0
	54	23	6	10	4	0		10	16	2	6	0	2
1891	3	8	0	1	0	0	1906	5	1	0	0	0	0
1892	3	2	0	0	0	0	1907	1	5	0	1	0	0
1893	1	0	0	11	28	9	1908	3	1	0	1	0	1
1894	10	7	0	11	0	0							
1895	8	3	0	1	0	0		9	7	0	2	0	1
	27	20	0	24	23	9	Grand total	150	100	11	71	28	12

In seven cases no districts were mentioned.

The native districts and the geographical divisions used by the United States census do not correspond on this island, so it is impossible to give the morbidity of the disease by districts. On examining Table 6 it will be seen that the Kona district yields the largest number of cases of leprosy per year.

It will be noted that in the year 1893 twenty-three cases of leprosy came from the Napali district. The region in question is one of the most inaccessible parts of the Territory, and a number of lepers had congregated there under the leadership of a leper outlaw. It was necessary to use military force to bring about the arrest of these cases. This episode was a part of the policy of enforcing the segregation coincident with the revolution which ushered in the republican form of government in 1893.

TABLE 7.—*Number of new cases of leprosy apprehended by years and by five-year periods from the island of Molokai.*

Year.	New cases.	Year.	New cases.	Year.	New cases.
1881	26	1891	11	1901	3
1882	13	1892	1	1902	1
1883	18	1893	8	1903	2
1884	11	1894	14	1904	2
1885	31	1895	3	1905	1
	99		37		9
1886	17	1896	9	1906	0
1887	24	1897	15	1907	13
1888	7	1898	5	1908	0
1889	9	1899	0		
1890	8	1900	0		13
	65		29	Grand total	252

Some of the cases of leprosy originating on the island of Molokai were boys born of leprous parents, who remained at the leper settlement until they contracted the disease; while some were clean native helpers at the settlement, who had become superannuated and were put on the leper list (with their consent) in order that they might receive rations. After deducting these two classes of cases, the number of bona fide cases of leprosy originating on the island of Molokai, outside of the leper settlement, is too small for statistical treatment.

TABLE 8.—*Number of new cases of leprosy each year per 10,000 of the population by races.*

Year.	Hawaiian and part Hawaiian.	Caucasians.	Other nationalities.	Year.	Hawaiian and part Hawaiian.	Caucasians.	Other nationalities.
1881	41.1	2.7	2.5	1895	23.5	0.4	0.8
1882	15.5	.0	1.3	1896	36.4	1.1	.5
1883	66.7	.0	.6	1897	28.9	1.8	1.5
1884	23.2	.6	2.6	1898	18.4	1.8	.8
1885	22.3	1.1	1.4	1899	13.9	.7	.4
1886	8.4	1.5	1.3	1900	23.4	2.1	.8
1887	51.4	.5	1.2	1901	20.3	.3	1.1
1888	129.1	3.5	3.6	1902	16.7	2.0	.6
1889	72.4	1.0	2.2	1903	25.4	2.3	1.3
1890	41.5	2.4	3.2	1904	18.9	2.9	.8
1891	34.8	.9	.3	1905	22.5	1.3	1.1
1892	26.0	1.3	.6	1906	11.7	1.2	.8
1893	50.7	1.2	1.2	1907	21.7	2.7	.7
1894	37.0	1.6	1.3	1908	5.2	1.2	.3

We see by examining column 1 of Table 8 that the fluctuation in the relative number of new cases of leprosy per 10,000 of the native population coincides fairly well with the variations in the actual number of cases per year, as shown in Table 1, and the explanation is to be sought partly in the political history of the Territory. The policy in 1888 has undoubtedly influenced the incidence of the disease in the Territory up to 1900. Since that time, however, it is evident that the disease is gaining headway.

With regard to the Caucasian lepers (column 2), it is evident that the disease underwent a slight diminution in this race, following the policy of 1888, but that since 1900 the disease is increasing, both relatively and absolutely, in this class of the population. The occurrence of the disease in other nationalities in the Territory is a repetition of that amongst the Caucasians.

TABLE 9.—*Age of lepers at apprehension.*

Year.	1 to 5.	6 to 10.	11 to 15.	16 to 20.	21 to 25.	26 to 30.	31 to 35.	36 to 40.	41 to 45.	46 to 50.	51 to 55.	56 to 60.	61 to 65.	66 to 70.	71 to 75.	76 to 80.	81 to 85.	86 to 90.	91 to 95.	96 to 100.
1881	0	8	26	29	16	21	15	23	9	16	2	8	4	3	5	1	2	0	0	0
1882	2	7	5	13	4	13	1	4	3	4	1	4	1	1	2	3	0	0	0	0
1883	0	9	27	40	23	42	25	25	25	27	17	15	10	6	1	5	0	4	0	0
1884	1	5	16	12	7	10	12	18	2	10	4	6	3	1	0	0	0	1	0	0
1885	1	6	2	19	7	15	5	19	6	12	1	4	0	4	0	0	0	0	0	0
1886	0	0	3	5	2	3	1	5	5	5	0	4	1	0	0	0	0	0	0	0
1887	1	14	35	36	22	19	18	22	17	7	10	10	2	4	0	2	0	0	0	0
1888	6	29	104	91	59	55	31	49	25	42	17	19	10	8	2	3	2	2	0	0
1889	1	25	56	50	41	25	18	19	11	15	11	14	5	4	1	4	1	3	0	0
1890	0	15	29	30	12	23	13	22	5	14	5	11	0	3	0	1	0	0	0	0
1891	1	14	22	26	15	11	11	9	5	12	1	8	2	5	0	0	0	0	0	0
1892	1	10	22	25	10	10	12	5	3	1	4	3	0	3	0	1	0	0	0	0
1893	0	14	37	34	28	27	18	8	9	12	4	7	4	4	4	0	0	0	0	0
1894	0	10	33	33	12	9	5	10	6	6	6	4	1	0	0	1	0	0	0	0
1895	0	13	18	27	9	8	5	6	5	3	5	5	0	2	0	0	0	0	0	0
1896	1	11	17	35	14	11	10	13	7	8	5	3	3	3	2	4	0	0	0	0
1897	1	9	34	14	12	14	14	8	6	4	3	2	1	0	2	0	0	0	0	1
1898	0	5	16	15	4	6	4	8	4	1	7	6	0	0	1	3	0	0	0	0
1899	0	3	11	14	9	6	4	7	3	0	0	0	1	0	0	0	0	0	0	0
1900	1	4	13	35	11	8	3	6	4	6	2	4	2	2	0	0	0	0	0	0
1901	0	4	18	19	11	9	3	9	4	2	2	1	1	3	0	0	0	0	0	0
1902	0	7	11	15	7	8	5	6	1	5	1	3	1	3	1	0	0	0	0	0
1903	0	5	19	25	19	15	6	4	3	7	6	1	2	3	0	0	0	0	0	0
1904	2	8	16	10	12	8	2	9	2	5	4	3	2	1	2	0	0	0	0	0
1905	0	5	14	13	10	9	11	12	4	7	8	3	1	1	0	0	0	0	0	0
1906	0	1	11	9	10	4	6	2	1	3	1	2	2	2	1	0	0	0	0	0
1907	2	5	9	15	15	14	8	8	5	1	6	5	1	1	0	0	0	0	0	0
1908	0	2	5	4	5	2	2	0	3	1	2	0	0	0	0	0	0	0	0	0
Total	20	248	629	693	406	405	268	336	183	236	135	155	60	67	24	28	5	10	0	1

There were thirty-one cases recorded with no age given.

The analysis of Table 9 shows that there are more cases of leprosy between the ages of 10 and 31 than all the other periods together. This indicates clearly that the disease is one which affects particularly the adolescent and young adult elements of the population. It is, therefore, a factor in the economic problem in the Territory, as the majority of its victims are of the age of maximum working efficiency.

If we divide the twenty-eight years under consideration into two periods of 14 years each and compute the percentage of lepers under 30 years of age and over 30 years of age for each of these 14-year periods, we find that during the latter period (1895–1908) there has been a distinct, though slight, relative increase in the number of lepers under 30 years of age, as against the first period. This accentuates the conclusion drawn from the total figures, to wit: That the disease is pre-eminently one of the public-school and early adult-life periods.

TABLE 10.—*Sex of lepers apprehended, by years.*

Year.	Males.	Females.	Year.	Males.	Females.
1881	131	63	1896	100	47
1882	52	18	1897	82	44
1883	184	116	1898	51	29
1884	71	37	1899	40	18
1885	74	29	1900	77	25
1886	23	9	1901	60	26
1887	137	83	1902	53	21
1888	348	210	1903	67	48
1889	178	218	1904	54	32
1890	109	74	1905	66	32
1891	81	61	1906	34	22
1892	60	49	1907	64	31
1893	128	82	1908	19	7
1894	85	51			
1895	64	42	Total	2,502	1,434

An examination of Table 10 shows that approximately two-thirds of the cases of leprosy occur in males. Such a sex distribution of the disease has been observed in other countries, but so far as we are aware no adequate explanation of the phenomenon has been found.

The predominance of males among the lepers, unless due to a sex susceptibility, would indicate that the disease is acquired without rather than within the home circle. This deduction is not in accord with the current theories as to the mode of transmission of leprosy.

The sex distribution of the disease again emphasizes its economic importance, as it attacks preeminently wage-earners.

TABLE 11.—*Number of new cases of leprosy a year (1901–1905) per 10,000 of the living Hawaiian and part Hawaiian population at different age periods.*

Age.	Number per 10,000.	Age.	Number per 10,000.	Age.	Number per 10,000.
0 to 10	6.6	31 to 40	27.2	61 to 70	20.0
11 to 20	41.8	41 to 50	21.2		
21 to 30	32.4	51 to 60	32.0		

Table No. 9 dealt with the absolute number of lepers of different age periods. In Table 11 is shown the ratio between the number of Hawaiian and part Hawaiian lepers of different age periods, and the number of Hawaiians and part Hawaiians of the same age period. It is evident from this table that the absolute as well as

the relative greatest incidence of the disease falls in the second decade (11 to 20 years of age). It has been shown that the average duration of the disease before apprehension in the Territory has been four years; we therefore feel justified in concluding that a very large proportion of all cases of leprosy receive their infection during the school-age period.

TABLE 12.—*Estimated number of Hawaiian lepers at large at the close of 1907.*

Average annual yield of lepers	72
Average duration of disease, years	4
Estimated Hawaiian population, 1906	35,000
Gross estimated lepers at large	288
Death rate of lepers (1903-1905), per cent	11
Correction: Lepers dying at large	71
Net lepers at large, end of 1907	217
Estimated number of Hawaiians per leper at large	165
Estimated leper at large per 1,000 of native population	6

This computation was made to determine the minimum number of Hawaiian and part-Hawaiian inhabitants of the Territory that should be examined to yield a case of leprosy not yet officially recognized. The computed number of lepers at large, therefore, does not include cases free in the community. It simply means that if the patients have the disease on an average of four years before segregation is effected, unless there be a sudden change in the death rate at large or in the spread of the disease in the community, there will always be what we might call a residuum of over two hundred undetected lepers free in the community. If segregation is not being rigidly enforced or has not been rigidly enforced during the period from which we draw our statistics for this computation, it is obvious that the total lepers at large must be very much greater.

TABLE 13.—*Lepers of school age, 1899 to 1908, inclusive.*

Territory of Hawaii:	
Total lepers apprehended in Territory for this period	796
Lepers of school age, same period (6 to 15 years of age)	171
Percentage of lepers of school age	21½
Annual average yield of school age lepers	17.1
City of Honolulu:	
Total lepers apprehended in Kona district, island of Oahu	291
Lepers of school age, same period (6 to 15 years of age), Kona district, island of Oahu	69
Percentage of lepers of school age	23
Annual average yield of school age lepers	6.9

In several previous tables we have called attention to the close relation which subsists between age and the occurrence of leprosy. The predominance of the disease in the early decades of life immediately suggests that if the public school system is conducted without

thoroughgoing inspection, it may be functionating as a vehicle for the dissemination of leprosy as well as education.

A scrutiny of this table shows that one-fifth of all lepers apprehended in the Territory each year are of school age, and that in the city of Honolulu almost one-quarter of the lepers each year are of the same age period. In other words, the Territory yields over seventeen "school age lepers" and the city of Honolulu over six "school age lepers" each year.

In considering these figures it must be borne in mind that inasmuch as all lepers segregated have had the disease for some years before apprehension, a certain number of lepers which do not figure in the above computation must have received their infection when they were or should have been in school.

TABLE 14.—*General leprosy statistics, Hawaii.*

Year.	New cases.	Total lepers in segregation.	Died.	Mortality.	Year.	New cases.	Total lepers in segregation.	Died.	Mortality.
				Per cent.					*Per cent.*
1866	142	115	26	22.6	1888	558	1,035	188	18.1
1867	37	150	25	16.6	1889	306	1,187	150	12.6
1868	111	232	30	12.5	1890	184	1,213	158	13.0
1869	125	276	79	28.2	1891	142	1,142	213	18.6
1870	27	270	58	21.4	1892	109	1,095	147	13.4
1871	181	399	51	12.7	1893	210	1,153	149	12.9
1872	105	437	64	14.6	1894	137	1,124	154	13.7
1873	477	757	156	20.6	1895	106	1,067	130	11.9
1874	90	674	161	23.8	1896	147	1,115	115	10.3
1875	213	706	157	22.2	1897	126	1,099	139	12.7
1876	96	677	122	18.0	1898	80	1,059	113	10.6
1877	157	710	109	15.3	1899	58	1,014	104	10.2
1878	237	696	245	35.2	1900	102	983	137	13.9
1879	41	717	208	29.0	1901	86	900	177	19.6
1880	51	612	150	24.5	1902	74	874	106	12.2
1881	195	709	130	18.3	1903	115	872	101	11.5
1882	70	651	121	18.4	1904	86	855	107	11.3
1883	301	784	150	19.0	1905	98	853	95	11.1
1884	108	717	169	23.4	1906	56	833	84	10.0
1885	103	653	142	20.2	1907	95	808	88	10.8
1886	42	598	100	16.7	1908	26	796	25	3.1
1887	220	696	110	17.1					

The significance of the column showing new cases has been discussed previously (Table 1). From the column of total lepers we see that following the vigorous segregation of lepers in 1887, 1888, and 1889 for a period of ten years the Territory had the burden of supporting over 1,000 cases in their isolation colony. In spite of this increase in the population of the settlement, the death rate, as shown by the last column, was much lower than during the earlier years of segregation. In this connection the territorial authorities should be congratulated upon the steady decrease of the death rate in the leper settlement, showing the results of the excellent hygienic conditions with which the Territory surrounds sufferers from the disease.

TABLE 15.—*Actual number of white lepers segregated, by years and by seven-year periods.*

Year.	Oahu.	Hawaii.	Maui.	Kauai.	Molokai.	Total.	Year.	Oahu.	Hawaii.	Maui.	Kauai.	Molokai.	Total.
1881	3					3	1895	1					1
1882						0	1896	2	1				3
1883						0	1897	3	1			1	5
1884	1					1	1898	2		1		2	5
1885	1		1			2	1899		1		1		2
1886	2				1	3	1900	2	2	1	1		6
1887	1					1	1901	1					1
	8		1		1	10		11	5	2	2	3	23
1888	2		4			7	1902	5		1			6
1889	2					2	1903	7					7
1890	4			1		5	1904	7		2			9
1891	2					2	1905	4					4
1892	1			2		3	1906	3	1				4
1893	2		1			3	1907	4	2	1	1	1	9
1894	2	1			1	4	1908	2	1		1		4
	15	1	5	3	2	26		32	4	4	2	1	43
							Grand total...	66	10	12	7	7	102

The total number of white lepers segregated in the Territory during the last twenty-eight years was 102, an average of 3.6 lepers per year. As these figures are based upon the official statistics of the board of health, no account is taken in them of the white lepers who have sufficient means to leave the Territory upon the discovery of the disease.

The island of Oahu produces over one-half of the white lepers. In twenty-eight years sixty-six such cases have come under the official notice of the board of health, an average of 2.35 per year.

The census of 1900 showed that 49 per cent of the white population of the Territory was on the island of Oahu, so it is to be expected that at least one-half of the white lepers would come from that island. If, however, we consider the distribution of the disease by islands for the seven years following the census year (1900) we see that the island of Oahu, with 49 per cent of the white population of the Territory, has produced 74 per cent of the white lepers apprehended during that time.

If we divide the period of twenty-eight years (1881–1908), covered by our statistics, into four equal periods of seven years each, we find that in the Territory at large leprosy is increasing among the whites, an increase which has become alarming during the last seven years: 1881–1887, ten cases; 1888–1894, twenty-six cases; 1895–1901, twenty-three cases; 1902–1908, *forty-three* cases. Grouping the cases of leprosy among the whites from the island of Oahu in the same way, we find that the disease has spread very rapidly among the whites on that island in the last seven years: 1881–1887, eight cases; 1888–1894, fifteen cases; 1895–1901, eleven cases; 1902–1908, *thirty-two* cases.

CONCLUSIONS.

1. Leprosy in Hawaii is quite evenly distributed throughout the Territory. The morbidity of the disease varies somewhat on different islands, and is most prevalent among the Hawaiian and part Hawaiian portion of the population, but is everywhere so high that the results of comparison are of trivial importance in the face of such a great menace to public health as an average of well over twenty per 10,000 of the native population. (Table 2.)

2. Leprosy in Hawaii is not confined to the remote districts, the capital of the Territory being one of the principal sources of cases. (Table 3.)

3. The prevalence of leprosy in certain districts on the island of Hawaii is notable. (Table 4.)

4. Leprosy in the Territory is most prevalent in the adolescent and early adult age periods and therefore bears a distinct relation to the public education, as the bulk of the lepers are either of school age or have received their infection during that period. (Table 9.)

5. The predominance of males (Table 10) and young adults (Table 9) among lepers in the Territory introduces the disease as an element in the local economic problem. Segregation withdraws many wage-earners from the community in their early prime.

6. The close relationship which exists between the occurrence of leprosy and the school age period indicates that a campaign for the control of the disease can not be successful, which does not contemplate careful supervision of the conditions under which this class of the population congregate, i. e., the school room. (Table 11.)

7. It seems evident (Table 13) that an elaborate public school system without thoroughgoing medical inspection may result in the development of an institution for the propagation of leprosy as well as the dissemination of knowledge. (Table 12.)

8. The steady improvement in the hygienic conditions in the Leper Settlement, as shown by the decrease in the death rate, testifies strongly to the practical humanitarianism of the Territory of Hawaii in dealing with the sufferers from the disease. (Table 14.)

9. There has been a notable increase in the number of cases of leprosy among the white inhabitants of the Territory of Hawaii in the last seven years, particularly on the island of Oahu.

A PALLIATIVE TREATMENT FOR LEPROUS RHINITIS.

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Complaints of epistaxis and nasal obstruction from two-thirds of the lepers under treatment brought home to us the desirability of seeking a palliative treatment for leprous rhinitis.

A careful search of the literature at our command revealed one reference to the treatment of leprous rhinitis.[a] Hollmann found the use of a spray, composed of eucalyptol and alboline, followed by insufflation with aristol, was beneficial. It occurred to one of us (J. T. W.) that acetozone inhalant,[b] which had proved of value in nonleprous nasal conditions, might be used in leprous rhinitis. Each patient was given an atomizer containing acetozone inhalant (acetozone 1 per cent, chloretone 0.5 per cent in liquid petrolatum) with directions to spray the nasal cavity through the anterior nares three times a day. An oil or vaseline atomizer is essential, as a fine, wide-reaching spray is desired in order to reach the mucous membrane on all sides of the nasal cavity. An inspection of the nose and a microscopic examination of the nasal secretion for lepra bacilli was made in each case before the medication was begun. The bacteriological examination consisted in collecting the nasal secretion, from both sides of the septum, on a sterile cotton swab, smearing it on new clean slides, fixing by heat, and staining for acid-fast bacilli, using Ziehl's carbfuchsin, steaming one minute, decolorizing for ten seconds in 1 per cent nitric acid in 95 per cent alcohol, and counterstaining with Löffler's methylene blue one minute.

In certain instances a smear was prepared from the material scraped from the septum with a rigid spear-pointed platinum needle. The mucous membrane was lightly scarified, the denuded area being

[a] Hollmann, H. T., 1907. Diseases of the Ear, Eye, Nose, and Throat, among Persons Afflicted with Leprosy. New York Medical Journal, October 26, 1907.

[b] New and nonofficial remedies approved by Council of Pharmacy and Chemistry of the American Medical Association.

scraped with the edge of the needle, the material clinging thereto was smeared on clean, new slides and stained as above.

All the patients receiving the spray had some leprous nasal lesion, the dominant subjective symptom being that of nasal obstruction, while objectively the mucous membrane of the septum showed ulcerations and thickening.

Case No. 1.—Type of disease, tubercular; age, 10 years; sex, male; duration, several years; nationality, Hawaiian. Physical examination: Thickening of the skin over both malar eminences, brows, and ears; tubercles on cheeks, forehead, ears and extremities. Diagnosis of leprosy confirmed bacteriologically.

January 5: Inspection of the nose. No ulcer present; hyperemia with thickening of the mucous membrane on both sides of the septum, with nasal obstruction sufficient to cause interference with sleep. Both sides of the septum bleed freely on swabbing. Microscopic examination: Many acid-fast bacilli, singly and in bundles, having the morphology of the Bacillus lepræ, are present in the secretion.

May 20. Receives a nasal spray with directions to use it three times daily.

June 7: Inspection of the nose (18 days). Nasal obstruction much diminished, no ulcer present, mucous membrane on the left side of the septum bleeds readily on swabbing. Microscopic examination of the secretion from the mucous membrane of the septum shows no acid-fast bacilli.

June 14: Inspection of the nose (25 days). Nasal obstruction has disappeared to such an extent that there is no longer any interference with respiration. Microscopic examination of the secretion from the mucous membrane of the septum shows no acid-fast bacilli. Microscopic examination of two smears made from a scraping of the mucous membrane on the right side of the septum shows no acid-fast bacilli.

July 20: Microscopic examination (61 days) of the nasal secretion and of a scraping from the mucous membrane of the nasal septum shows no acid-fast bacilli.

August 6: Inspection of the nose (78 days). No ulcer present, the hyperemia and thickening of the mucous membrane of the nasal septum and the nasal obstruction have disappeared. Microscopic examination of the nasal secretion and of a scraping from the mucous membrane of the septum shows no acid-fast bacilli.

Case No. 2.—Type of the disease, mixed; age, 20 years; sex, male; duration of disease, 4 years; nationality, Hawaiian. Physical examination: Anesthesia of both legs below the knees, and of both forearms in the distribution of the ulnar nerve. Tubercles on both cheeks, forehead, and ears. Infiltration with thickening of the skin over both malar eminences, brows, and ears. Diagnosis of leprosy was confirmed bacteriologically.

January 5: Inspection of the nose. Open ulcers on both sides of the septum, with a thickening of the mucous membrane, especially on the right side, with nasal obstruction. Left side of the septum bleeds readily on swabbing. Microscopic examination: Many acid-fast bacilli, singly and in small bundles, having the morphology of the lepra bacillus, are present in the secretion.

March 24: Received a nasal spray with directions to use it three times daily.

June 1: Inspection of the nose (68 days). Open ulcer on right side, but greatly reduced in size. Ulcer on left side has disappeared, but the mucous membrane still bleeds freely on swabbing. Nasal obstruction has disappeared, and the mucous membrane on the left side appears no longer thickened, but a hyperemia still remains. Microscopic examination: Many single acid-fast bacilli were found in the secretion, the small bundles having almost disappeared. The bacilli were morphologically like the lepra bacillus.

June 14: Inspection of the nose (82 days). Ulcer present on right side, and is healing around the edges. Left side appears normal. Microscopic examination of the secretion from the mucous membrane shows a few small bundles of acid-fast bacilli. Microscopic examination of the smears made from a scraping of the mucous membrane on the right side of the septum shows many acid-fast bacilli, singly and in bundles, morphologically like the lepra bacillus.

August 6: Inspection of the nose (135 days). Ulcer on the right side is no longer visible; however, at the junction of the bony and cartilaginous septum some hemorrhagic crusts are present. Microscopic examination of the nasal secretion shows a few single and one small bundle of acid-fast bacilli, morphologically like the Bacillus lepræ. Microscopic examination of the smears made from a scraping of the mucous membrane of the right side of the septum shows many single acid-fast bacilli.

Case No. 3.—Type of the disease, tubercular; age, 41 years; sex, male; duration, 8 months; nationality, part Hawaiian. Physical examination: Infiltration of the skin over the malar eminences and brows; tubercles on ears and left arm. Anesthesia of forearms and entire legs. Diagnosis of leprosy confirmed bacteriologically.

January 5: Inspection of the nose. Deviation of the septum to the right; large open ulcer on the right side; thickening of the mucous membrane on both sides of the septum, with complete nasal obstruction. Mucous membrane on both sides of the septum bleeds readily on swabbing. Microscopic examination of the nasal secretion shows enormous numbers of acid-fast bacilli, singly and in large bundles, morphologically like the lepra bacillus.

March 24: Received a nasal spray with directions to use it three times a day.

May 18: Inspection of the nose (55 days). No ulcer is visible; the thickening of the mucous membrane has entirely disappeared, and there is no longer nasal obstruction. Microscopic examination of the nasal secretion shows no acid-fast bacilli. Microscopic examination of smears made from a scraping of the mucous membrane shows no acid-fast bacilli.

June 1: Use of the spray suspended (69 days).

June 14: Inspection of the nose (14 days). No ulcer present and the mucous membrane appears normal. Microscopic examination of the nasal secretion shows no acid-fast bacilli.

Microscopic examination of smears made from a scraping of the septum shows no acid-fast bacilli.

July 8: Inspection of the nose (38 days). Mucous membrane on both sides of the septum appears normal. Microscopic examination of the nasal secretion shows no acid-fast bacilli. Microscopic examination of smears from a scraping shows eight single long, slender, and beaded acid-fast bacilli, morphologically like the lepra bacillus.

July 12: Resumed the use of the spray.

August 6: Inspection of the nose (25 days). Mucous membrane on both sides of the septum appears slightly pale and is very dry. No ulcer is visible. There is a small hemorrhagic crust at a level with the anterior part of the middle turbinate bone. Microscopic examination of the nasal secretion from both sides of the septum shows no acid-fast bacilli. Microscopic examination of smears made from a scraping of the mucous membrane from the right side of the septum, beneath the hemorrhagic crust, shows no acid-fast bacilli.

Case No. 8.—Type of the disease, macular-anesthetic; age, 19 years; sex, male; duration, 16 months; nationality, American. Physical examination: A thickening of the skin with macules over both malar eminences, also large macules radiating downward and outward from each side of the spine; anesthesia in the distribution of both ulnar nerves, with contracture of the third and fourth fingers of each hand. Diagnosis of leprosy confirmed bacteriologically.

March 8: Inspection of the nose. Large open ulcer on the right side of the septum; hyperemia and thickening of the mucous membrane with partial nasal obstruction. Both sides of the septum bleed readily on swabbing. Microscopic examination of the nasal secretion shows many bundles and single acid-fast bacilli, having the morphology of the bacillus lepræ.

April 9: Received a nasal spray with directions to use it three times a day.

June 1: Inspection of the nose (53 days). Ulcer still present but greatly reduced in size. Nasal obstruction has entirely disappeared. General condition of the mucous membrane on both sides of the septum is much improved. Microscopic examination of the nasal secre-

tion shows a few bundles and a moderate number of single acid-fast bacilli, morphologically like the lepra bacillus. Microscopic examination of smears made from a scraping of the mucous membrane at the border of the ulcer shows many bundles and single acid-fast bacilli, morphologically like the lepra bacillus.

June 14: Inspection of the nose (67 days). The mucous membrane at the site of the ulcer presents a smooth, shiny surface, and the general congestion and thickening have entirely disappeared. Microscopic examination of the nasal secretion shows a few single, long, slender, and beaded acid-fast bacilli, morphologically like the bacillus lepræ.

August 6: Inspection of the nose (120 days). The mucous membrane of the right side of the septum is congested and at the anterior part of the middle turbinate bone is a small hemorrhagic crust. No ulcer is visible. Microscopic examination of the nasal secretion at the site of the hemorrhagic crust shows a few bundles and many single acid-fast bacilli, morphologically like the lepra bacillus.

The neuro-trophic lesions involving the patient's hands have prevented a thorough use of the atomizer.

Case No. 9.—Type of the disease, tubercular; age, 12 years; sex, male; duration, not known; nationality, Hawaiian. Physical examination: Infiltration of cheek, nose, chin, brows, and ears; many leucodermic areas on back and buttocks; elephantiasis of both lower extremities, with anesthesia below the knees. Diagnosis of leprosy was confirmed bacteriologically.

January 5: Open ulcers on both sides of the septum, with a congestion and thickening of the mucous membrane and complete nasal obstruction. Microscopic examination of the nasal secretion shows some bundles and many single acid-fast bacilli, morphologically like the bacillus lepræ. Microscopic examination of smear made from a scraping of the mucous membrane shows acid-fast bacilli, singly and in bundles, morphologically like the lepra bacillus.

April 9: Began using the nasal spray three times a day.

May 20: Inspection of the nose (41 days). No ulcer present on either side of the septum. The mucous membrane on the right side of the septum is congested. All signs of the obstruction have disappeared. Microscopic examination of the nasal secretion shows four single acid-fast bacilli, morphologically like the lepra bacillus.

June 8: Inspection of the nose (60 days). The mucous membrane on both sides of the septum is smooth and without secretion. No ulcer or congestion is present. Microscopic examination of the nasal secretion shows no acid-fast bacilli. Microscopic examination of smears made from scraping of the mucous membrane on the septum shows some single acid-fast bacilli, morphologically like the lepra bacillus.

June 8: The use of the spray was discontinued.

June 15: Microscopic examination of the nasal secretion, one week after discontinuing spray, shows no acid-fast bacilli.

July 20 (42 days): Microscopic examination of the nasal secretion shows no acid-fast bacilli. Patient complains of obstruction in upper nasal passage, so spray was again ordered.

August 6: Inspection of the nose (17 days). No ulcer present, no thickening of the mucous membrane, and the obstruction has again disappeared. The mucous membrane is very dry. Microscopic examination of the nasal secretion shows two acid-fast bacilli, very palely stained, not beaded, and rather thicker than the bacillus lepræ. Microscopic examination of smears made from a scraping of the mucous membrane shows a moderate number of acid-fast bacilli, brightly stained and morphologically like the lepra bacillus.

Case No. 11.—Type of the disease, tubercular; age, 69 years; sex, male; duration, unknown; nationality, American. Physical examination: Tubercles on ears and extremities; induration of the skin of the brows and ears; macules on body, buttocks and thighs; anesthesia of forearms and legs, with atrophy of the muscles of the forearms. Diagnosis of leprosy confirmed bacteriologically.

An atomizer, containing acetozone inhalant, was given this patient, to be used for an extensive ulceration of the right side of the septum, thickening of the mucous membrane, and complete nasal obstruction. The ulcer was partially healed, and the nasal obstruction was entirely relieved. The reason that more progress was not made was the patient's inability to use the atomizer properly because of his disabled hands.

Case II.—Type of the disease, mixed; age, 25 years; sex, male; duration, several years; nationality, Hawaiian. Physical examination: Thickening of the skin over cheeks and ears; scars on the face and body from former tubercles; one arm amputated for gangrene. Diagnosis of leprosy was confirmed bacteriologically.

January 5: Inspection of the nose. Ulcers on both sides of the septum, with hemorrhagic crusts; mucous membrane congested and thickened. Complete nasal obstruction was present. Microscopic examination of the nasal secretion shows many acid-fast bacilli, singly and in bundles, morphologically like the lepra bacillus.

March 24: Received a nasal spray with directions to use it three times a day. Inspection of the nose: A large open ulcer on the right side of the septum; hemorrhagic crusts on the left side. Gentle swabbing causes severe epistaxis. Nasal obstruction was distressing. Microscopic examination of the nasal secretion shows enormous numbers of acid-fast bacilli, singly and in bundles, morphologically like the lepra bacillus. Microscopic examination of smears made from a scraping of the nasal mucous membrane shows enormous numbers

of acid-fast bacilli. The field under the microscope appears almost entirely red from the bacilli present.

April 4: Inspection of the nose (11 days). No ulcer present on the left side of the septum. Right side of the septum shows a very small ulcer, with some hemorrhagic crusts still present. Microscopic examination of the nasal secretion shows some acid-fast bacilli, singly and in small bundles, morphologically like the lepra bacillus. Many of the bacilli in this specimen take a very uneven and pale stain.

April 21: Microscopic examination of the nasal secretion (28 days) shows a few acid-fast bacilli, morphologically like the lepra bacillus.

May 18: Inspection of the nose (55 days). No ulcers visible on either side of the septum, but at the site of the ulcers the mucous membrane appears red, glistening, and dry. The mucous membrane on the left side of the nasal septum appears normal. No hemorrhagic crusts are present, and all signs of the nasal obstruction have disappeared. Microscopic examination of the nasal secretion shows two small bundles and a few single acid-fast bacilli, morphologically like the lepra bacillus.

July 20: Inspection of the nose (118 days). No ulcer present on either side of the septum. The mucous membrane appears rather pale and very dry. During the process of swabbing a small hemorrhagic crust was removed, but no bleeding point could be detected. Microscopic examination of the nasal secretion shows eleven single acid-fast bacilli, long and slender, not beaded, and but faintly stained, morphologically like the lepra bacillus.

Case L.—Type of the disease, tubercular; age, 9 years; sex, female; duration, unknown; nationality, Hawaiian. Physical examination: Infiltration of the entire face and ears; macules on arms and back; macules and small tubercles on lower extremities; diagnosis of leprosy was confirmed bacteriologically.

January 5: Inspection of the nose. The entire left side of the septum is a large open ulcer, right side shows hemorrhagic crusts, and the mucous membrane is thickened. Nasal obstruction is present. Microscopic examination of the nasal secretion shows enormous numbers of acid-fast bacilli, predominantly in large bundles, morphologically like the lepra bacillus. Microscopic examination of smears made from a scraping of the nasal mucous membrane shows very numerous groups of acid-fast bacilli, morphologically like the lepra bacillus.

May 7: Inspection of the nose shows practically the same condition as described in the examination of January 5. Patient began treatment with the nasal spray, with directions to use it three times a day.

June 1: Inspection of the nose (25 days). Ulcer almost healed; mucous membrane around the ulcer is hyperemic; mucous membrane on the other side of the septum appears normal; nasal obstruction has entirely disappeared; microscopic examination of the nasal secretion shows some acid-fast bacilli, morphologically like the lepra bacillus.

July 20: Inspection of the nose (74 days). No ulcer visible; some hemorrhagic crusts on the right side on a level with the anterior part of the middle turbinate bone. The mucous membrane appears swollen and pale. Microscopic examination of nasal secretion shows one small bundle and a few single acid-fast bacilli, morphologically like the lepra bacillus. The bundle of bacilli was stained a pale pink and no beading of the component bacilli could be made out.

Case C.—The type of the disease, mixed; age, 22 years; sex, female; duration, several years; nationality, Hawaiian. Physical examination: Thickening and induration of the skin of the cheeks, brows, ears, and chin. Tubercles on forehead, ears, arms, buttocks, and lower extremities. Large macules on the back. Enlargement of both ulnar nerves, with atrophy of the interosseous muscles of the hands and a contracture of all the fingers of both hands. Diagnosis of leprosy was confirmed bacteriologically.

January 5: Inspection of the nose. Large open bleeding ulcer on the left side of the septum. The mucous membrane on both sides of the septum is thickened and there is partial nasal obstruction. Slight trauma of the mucous membrane on the left side of the septum causes severe epistaxis. Microscopic examination of the nasal secretion shows enormous numbers of acid-fast bacilli, singly and in bundles, morphologically like the lepra bacillus.

April 21: Received the nasal spray, with directions to use it three times a day.

June 1: Inspection of the nose (41 days). Ulcer on the left side of the septum greatly reduced in size; mucous membrane no longer thickened, and the nasal obstruction is entirely gone. Mucous membrane on the right side of the septum appears normal. Microscopic examination of the nasal secretion shows a few acid-fast bacilli, singly and in small bundles, morphologically like the lepra bacillus. This specimen shows that the bacilli in the secretion are greatly reduced in numbers, and that many take the stain poorly.

July 20: Inspection of the nose (90 days). No ulcer present; however, there are some hemorrhagic crusts at the site of the former ulcer. The mucous membrane on both sides of the septum is dry and glistening. Microscopic examination of the nasal secretion shows some single, long, and slender acid-fast bacilli (swabbing made from the site of one of the crusts), morphologically like the lepra bacillus. Many of the bacilli take the stain so faintly that no beading could be

made out, and again appeared so short that they seemed to be mere parts of the bacilli.

July 30: For disciplinary reasons this patient was sent to the settlement on the island of Molokai, ending our investigations of the case.

Case E.—Type of disease, tubercular; age, 24 years; sex, male; duration, several years; nationality, Hawaiian. Physical examination: Slight thickening of the skin over the cheeks and brows; ears somewhat enlarged; leucodermic areas on the body on lower extremities. Diagnosis of leprosy was confirmed bacteriologically.

January 5: Inspection of the nose. There were several hemorrhagic crusts on the right side of the septum, which when removed brought to view several small ulcers. The mucous membrane was thickened. There was complete nasal obstruction. Microscopic examination of the nasal secretion from the site of one of the crusts shows a moderate number of acid-fast bacilli, singly and in bundles, morphologically like the lepra bacillus.

April 9: Patient received the nasal spray with directions to use it three times a day.

May 18: Inspection of the nose (39 days). No ulcer present; no hemorrhagic crusts; thickening of the mucous membrane greatly reduced, and the nasal obstruction has entirely disappeared. Microscopic examination of the nasal secretion shows a few single, long, slender, beaded acid-fast bacilli, morphologically like the lepra bacillus.

June 7: Inspection of the nose (59 days). No ulcer or hemorrhagic crusts present; mucous membrane slightly pale, dry, and glistening. Microscopic examination of the nasal secretion shows no acid-fast bacilli. Microscopic examination of smears made from a scraping of the mucous membrane at the site of one of the former ulcers shows a few single acid-fast bacilli, morphologically like the lepra bacilli.

July 30: This patient was sent to the settlement on the island of Molokai, for disciplinary reasons, terminating our investigations.

SUMMARY.

The results of the treatment of ten cases of leprous rhinitis with acetozone inhalant may be summarized as follows:

1. Nasal obstruction relieved in ten cases.

2. In nine cases presenting ulcerations of the mucous membrane of the nasal septum, eight showed healing of the ulcers.

3. Entire disappearance of the lepra bacilli from the nasal secretion was observed in four cases. In two of these cases the bacilli could not even be demonstrated in a scraping of the mucous membrane of the septum. In the six cases remaining the bacilli in the nasal secretion were greatly reduced in number.

DISCUSSION.

In the summary it will be noted that there were six cases in which the bacilli did not entirely disappear from the nasal secretion during the treatment. This may be explained as follows:

Three of these six cases (Nos. 8, 11, and H) could not use the atomizer effectively because of their disabled hands. Case No. 2, who has shown steady progress in the severity of his leprosy, was confined to his bed for some time with a leper fever, during which the spray was not used. This patient also has a tubercular infection, evidenced by a cervical adenitis, necessitating operation.

Case C was sent to the leper settlement before our investigations were completed.

Case L is a young girl, who has given us some trouble by refusing other medications, and it is known that she did not use the spray faithfully.

During the course of our bacteriological examinations of the nasal secretions of our patients, several peculiarities in the staining properties of the lepra bacillus were noted, apparently due to the action of the spray. These changes may be summarized as follows:

The first change noted was that the bundles of bacilli became smaller and they were fewer in number until, in several cases, they disappeared altogether, the bacilli being only found singly. The next change was in the staining properties of the individual bacilli, many of them taking the stain poorly and the beading seeming to be absent. In our last series of examinations of the nasal secretions a marked change was noticed in the bundles, as follows:

Occasional areas were found in the preparations of the size and shape of a bundle of lepra bacilli, composed of a homogeneous substance staining a faint pink, with acid-fast granules scattered throughout. These granules took a bright red stain, appearing like "beads" or the darker staining sections of the lepra bacilli. No individual bacilli could be made out in these areas, and the picture suggested a bundle of disintegrating bacilli with fusion of the component units.

The mechanism of communication of leprosy is unknown, but inasmuch as in tuberculosis we know that the disease may be transferred to a healthy person by "spray infection," and we know that in leprosy with nasal lesions a similar bacillary spray exists, we feel justified in reasoning by analogy and concluding that if the nasal secretion of a leper can be freed from the specific bacilli, the result will be prophylactically very important.

It is a routine measure with us to give each one of our patients, having a nasal lesion, an atomizer containing acetozone inhalant. This not only heals the ulcerations and to a greater or lesser extent rids the nasal secretion of the bacilli, but also makes the patient more comfortable by relieving the nasal obstruction.

CONCLUSIONS.

1. A systematic use of a spray composed of acetozone and chloretone in liquid petrolatum in cases of leprous rhinitis relieves the distressing nasal obstruction characteristic of the disease; brings about healing of the ulcerations so frequently present on the nasal septum, and greatly reduces the number or causes the entire disappearance of the lepra bacilli in the nasal secretion.

2. We believe that if this treatment is thoroughly carried out the lepra bacilli will eventually be entirely eliminated from the nasal secretion, a factor, which to our minds is so important in the communicability of the disease that it hardly requires emphasis.

3. From the point of view of the patient, a treatment which by relieving the nasal obstruction permits uninterrupted sleep, and by healing the ulceration of the nasal mucous membrane, frees him from epistaxis, is of considerable moment.

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TREASURY DEPARTMENT

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MARITIME QUARANTINE

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INTRODUCTION.

The main object in the preparation of this pamphlet was to arrange certain facts concerning maritime quarantine practice in a compact form for convenient use.

The author has availed himself of material from many sources, notably from the various annual reports of the service and from articles written on quarantine and sanitary subjects by the Surveyor-General. Various text-books and monographs have also been consulted, and pertinent information extracted therefrom; but specific mention can not be made of all of the sources of information, which, on account of the length of time intervening between the preparation of the article and its publication, can not now be recalled to mind.

L. E. C.

FIG. 1.—SHOWING THE PROPER WAY OF CLIMBING A VESSEL'S SIDE LADDER WHEN BOARDING FROM A LAUNCH.

MARITIME QUARANTINE.

By Assistant Surgeon-General Leland E. Cofer.

THE TYPES OF VESSELS MET WITH IN MARITIME QUARANTINE PRACTICE.

The most important general classification of ocean carriers, from a practical quarantine standpoint, is that of modern vessels as opposed to those of the old type. The modern steam vessel is almost without exception large, with a general arrangement tending to the wide and distinct separation, by bulkheads and decks, of the three classes of passengers on the one hand and of the different departments of the ship's personnel on the other. Such vessels have high superstructures amidships, in which the first-cabin passengers always and the second-cabin passengers frequently live in a world apart from everyone else on board. The steerage passengers are usually quartered around the main freight hatches forward and aft below the spar deck, and the seamen, firemen, and messmen are quartered on the same deck, but in separate compartments amidships. The old type steam vessel, although carrying out our traditional ideas of what is nautical, is seldom large, and is devoid of arrangement tending to a wide and distinct separation of classes and departments. The decks sweep gracefully fore and aft, and the superstructure frequently affords direct communication with any or all parts of the ship. The quarters on such vessels are constructed with reference to the conservation of freight space, and the separation of classes on board is, from a quarantine standpoint, purely imaginary.

Ocean carriers are classified for quarantine purposes as follows:

First. Modern steam vessels.

Second. Old type steam iron vessels.

Third. Naval vessels and military transports.

Fourth. Steel sailing vessels and tramp steamers.

Fifth. Wooden vessels.

Modern steam vessels.—The modern large steam vessels are rapidly replacing those of the old type on the transoceanic routes, and there is no doubt, from a sanitary standpoint, they are far safer than the old type of vessels. The large steamers are so expensive to maintain

that their runs are quicker and their time in port much shortened, all of which has a bearing on the chances of their becoming infected with the intermediate hosts of certain quarantinable diseases. These vessels are equipped with all the modern appliances for ventilating and for the automatic flushing of latrines. Below the water line the hull is divided into compartments by water-tight bulkheads, which probably limit the migration of vermin. Even the tightness of the hull affords some protection to the ingress of vermin.

Old type steam iron vessels. The old type steam iron vessels present rather the reverse of the conditions enumerated above, and for this reason are classified separately in determining their probable status from a quarantine point of view.

Naval vessels and military transports. Naval vessels and military transports, while they do at times become infected with, and are therefore capable of carrying, quarantinable disease, are comparatively safe for the reason that commercialism enters nowise into their conduct, and every officer on board is officially and morally the guardian of their sanitary integrity.

Steel sailing vessels and tramp steamers. Steel sailing vessels and tramp steamers usually make long voyages, visit many countries, have the carrying of freight as their sole aim, and, in short, present the greatest hazard to the quarantine officer of any of the varieties of ocean carrier.

Wooden vessels. Wooden vessels are placed in a class to themselves simply because once infected they present, on account of their construction, a great many obstacles to proper disinfection.

All signs point to the gradual substitution of steamers for sailing vessels all over the world, and it is predicted that this substitution will proceed more rapidly in the future than it has in the past. This fact has an important bearing upon the practice of maritime quarantine, for the reason that quarantine work in steamers presents far greater difficulties than in sailing vessels, steamers being more easily and more often infected than sailing vessels. The quarantine future therefore holds many reforms of procedure and judgment as the hazard of infection transmission increases with the change from sail to steam.

Maritime Quarantine Practice.

THE BOARDING OF VESSELS.

The boarding of vessels for the purpose of making the quarantine inspection is done by means of boarding steamers. Boarding steamers vary in character and size according to the amount of wind and rough weather likely to be encountered, the distance to be covered in reaching vessels, and the probable necessity of their being utilized

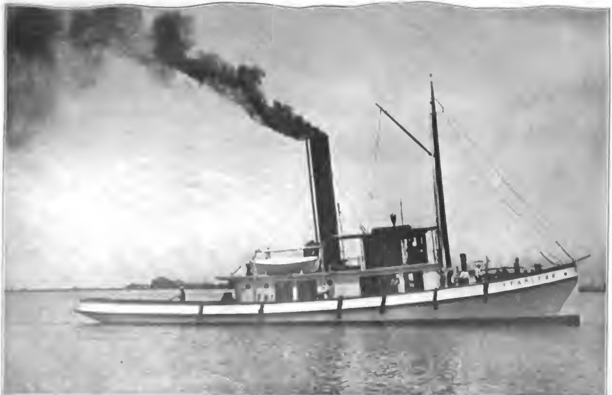


FIG. 2.—TYPE OF TUGBOAT USED AS BOARDING STEAMER

FIG. 3.—A STEAM BOARDING LAUNCH, THE "OAHU," ATTACHED TO THE U. S. QUARANTINE STATION AT HONOLULU.

FIG 4.—A BOARDING WHALEBOAT (HONOLULU QUARANTINE STATION).

for towing. Where large boarding steamers are required, vessels of the tugboat type may be especially constructed, or ordinary tugboats may be easily converted to fulfill the purpose.

Boarding steamers and launches.—For boarding in comparatively smooth water and where only short distances are to be traveled in reaching vessels waiting for quarantine inspection, small steam launches are commonly used and give universal satisfaction.

Vessels should be boarded promptly upon their arrival, within reasonable limitation. The approach of vessels is usually heralded through the courtesy of maritime marine exchanges or pilots, and the notice given is usually sufficient to enable the boarding steamer to reach the designated quarantine anchorage by the time the expected vessel arrives there. The boarding of vessels should not be attempted when the sea is rough enough to jeopardize the safety either of the boarding steamer or its personnel. The fact of the inability to board on account of the conditions above mentioned should be made known through the international signal code.

A boarding steamer should be kept in a state of perfect neatness, and manned by capable men under the proper discipline. The crew of the steamer should be required to wear the proper uniform and present in every way a businesslike appearance. When approaching a vessel the pilot must decide whether the big vessel is furnishing a proper lee, and also whether there are obstacles to a safe and sightly landing alongside. In the event conditions are not suitable, a quiet request for their adjustment should be made through the megaphone, the boarding vessel laying to in the meanwhile. A bungling or unseamanlike landing alongside of a vessel creates an unfavorable impression, to say the least, and is liable to cause a certain amount of confusion and excitement which is frequently ludicrous and which reflects discredit upon a function which should be deliberate from beginning to end.

Formality of boarding.—The traditional and customary hours for boarding vessels are between sunrise and sunset, and vessels arriving at quarantine during these hours should be boarded without delay. In cases of exigency and in order to give quick dispatch to the large ocean mail carriers it is good practice to board at night, provided an orderly muster is possible and ample artificial light available. The boarding officer, having arrived alongside the vessel, boards over the starboard side, provided the wind and sea permit. The starboard gangway, being by tradition the one used by officers, may usually be made safe if the pilot or commander of the vessel to be boarded swings his vessel so as to throw the starboard side to the leeward. It is always understood that all formality is to be disregarded in the event of rough weather or exigency. Upon arriving on board of sailing vessels and tramp steamers, it is well for the boarding officer to invite the presence

of the captain at once, but in the case of passenger steamers, the ship's surgeon and purser are the officials whose presence will prove of the greatest utility. The captains of large steamers usually leave all details to their heads of departments, and unless some important question arises it is well not to ask the captain to leave the bridge.

THE INSPECTION OF VESSELS.

The inspection of vessels is the most important part of quarantine work. Indeed, successful maritime quarantine depends almost entirely upon its proper performance. An inspection of a vessel includes the consideration of the sanitary history of all ports visited by the said vessel, the present health status or quarantine credit of these ports, the inspection of all persons on board, and the collecting of collateral evidence bearing upon the sanitary status of the vessel.

Upon reaching the vessel's deck it is well for the boarding officer to make a quick but general survey of the ship's personnel and passengers as they are grouped about. More than once have important disclosures been made to quarantine officers in answer to pointed questions, which an undue interest in the officer's arrival or an appearance of expectancy on the part of groups of passengers or crew had suggested. In any event during this quick survey it is well to ask a few general questions bearing upon the length of the voyage and the occurrence of incidents worthy of mention. It frequently happens that information of considerable importance may be accidentally imparted which would be suppressed on more formal inquiry.

The quarantine officer should keep himself posted concerning the sanitary history of all of the principal ports of the world, and should consider the bearing which the general sanitary history of a port may have upon the recent real or alleged health status thereof.

The recent sanitary status of a port is learned through the Public Health Reports published by the Public Health and Marine-Hospital Service, through the consular and other bills of health carried by the vessel, and from special information received either by wire or by letter from medical or consular officers at the ports previously visited by the vessel.

FIG 5.—A MUSTER OF STEERAGE PASSENGERS THE BOARDING LAUNCH STANDING BY READY FOR ORDERS.

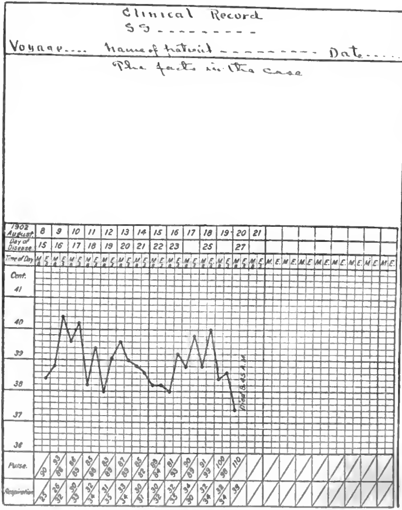


FIG 6.—PROPOSED CLINICAL CHART FOR SHIP SURGEONS

Sample improvised reference blank for recording the recent sanitary status of ports as obtained from bills of health.

ABSTRACT BILLS OF HEALTH.

S. S. "Hongkong Maru," arriving May 17, 1906.

Ports.	Two weeks ending—	Plague.		Cholera		Smallpox.	
		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Shanghai	Apr. 22, 1906					7	3
Hongkong	Apr. 29, 1906	65	60			21	13
Amoy	Not visited						
Manila	do.						
Nagasaki	May 2, 1906	Clean.					
Kobe	May 4, 1906	5	4				
Yokohama	May 8, 1906					2	0

From the bills of health a schedule of all persons on board should be quickly written out in the form of a memorandum.

Sample schedule for quarantine muster.

S. S. "Korea," arriving May 21, 1906.

Ports.	Embarked.				Disembarked.			
	First cabin.	Second cabin.	Steerage.	Crew.	First cabin.	Second cabin.	Steerage.	Crew.
Hongkong	77	0	62	279				
Shanghai	25	0	3	0	17	0	1	0
Nagasaki	5	0	2	0	14	0	3	0
Kobe	11	0	385	0	30	0	3	0
Yokohama	132	0	135	0	22	0	0	1
Total	250	0	587	279	83	0	7	1

The count of all persons on board when mustered should tally with the schedule.

The inspection of the vessel consists of an examination of all persons on board, and when necessary of the living apartments and hold of the ship.

The first step in the inspection of a vessel is an examination of all sick persons on board.

The clinical records, made out in the form prescribed, are carefully read. The patients are then examined, and the character of the surroundings and the element of isolation which they present are considered at the same time. After visiting the sick, the bodies of persons who have died at sea are viewed, and an autopsy performed if necessary. Next in order comes the general muster. It is needless to say that this must be entirely free from confusion. The purser is requested to assemble all first-cabin passengers in the dining saloon and have them take their places at the table. The roll is then called by the purser and each passenger rises in answer to name and passes

by the quarantine officer. The second-cabin passengers are inspected in a similar manner in their dining saloon. In mustering the steerage passengers, they should be further subdivided into nationalities.

These passengers are assembled on the spar deck aft. The method and extent of the examination of the steerage passengers varies with the disease or diseases existing at the vessel's port of departure or ports of call. Every inspection of groups of steerage passengers or crew includes a careful count of those present, and any discrepancy existing between the number found by the count and the number recorded in the memorandum for the ship's muster should be removed or satisfactorily explained. The face, forehead, and hands of everyone must be carefully examined. The deck force, firemen, and stewards are mustered separately on the spar deck forward and subjected to the same examination as that already described in the case of steerage passengers. The formal inspection of the vessel having been completed, the quarantine officer collects the collateral evidence as to the ship's sanitary status. The collateral evidence includes the general condition of the hull and the living quarters, the character and condition of the sanitary arrangements, and the condition of decks and holds as to general cleanliness. It also includes the question as to the probability of there being stegomyia mosquitoes on board, also the possible finding of dead rats during the voyage. The source of the water and vegetable supply and the kind of cargo carried are also considered in the light of collateral evidence. This concludes the ordinary port inspection.

THE JUDGMENT OF VESSELS.

The last step, the judgment of a vessel's sanitary status, is arrived at by weighing the findings of the inspection, that is, the conditions which were apparent at the time of the inspection, against the possibilities of concealed or latent infection.

Concealed or latent infection may apply either to the ship itself or to the personnel.

Concealed infection is usually concomitant with dishonest or ignorant captains or wily passengers and crew.

Latent infection is a condition dependent upon the character and condition of a vessel, her conduct while in an infected port, and the character of the quarantinable disease present in such port.

When a captain of a vessel compels men sick with quarantinable disease to stand in line to pass a quarantine muster, or makes a false certificate regarding the finding of dead rats on board during the voyage, he may be said to be concealing infection. On the other hand, when a passenger or member of the crew has had a very mild, modified, or attenuated attack of a quarantinable disease which has escaped all notice, the disease on the ship may be said to be latent.

The determination of concealed or latent infection in vessels is only possible after careful observation. Concealed or latent infection in vessels is the cause of most of the failures in maritime quarantine work, therefore it frequently happens that the quarantine officer is forced in the interest of public safety to impose the burden of proof as to the absence of latent or concealed infection upon the vessel.

The inspection of a vessel, as described above, only admits of the collection of some of the facts concerning the sanitary status of a vessel and its complement. In other words, only what is seen by the quarantine officer on the day and hour of the ship's arrival is known to him. That which may have happened on board during the voyage may be surmised or statements relative thereto may be accepted, but nevertheless nothing is supposed to be "known" for quarantine purposes except that which the quarantine officer sees either personally or through the agency of official certification which he is willing to accept.

The facts which may be gathered by the ordinary inspection comprise the information obtainable from the bills of health and the ship's papers, such as the sanitary history of the ports previously visited by the vessel, the existing sanitary status of the said ports, and the kind or kinds of quarantinable disease endemic therein. It is assumed of course that a vessel will always bring this information duly made out on the prescribed form and certified to by the United States consul or medical officer of the Public Health and Marine-Hospital Service, otherwise the act of 1893 will be violated and the vessel subjected to fine, and perhaps to detention in quarantine.

In addition to the facts enumerated above are those which the quarantine officer gathers through personal observation. These comprise the presence of quarantinable disease on board at the time of the inspection, the sanitary condition of the vessel, the type and nationality of the vessel, the various nationalities represented in the passenger lists, and the balance which an actual count of all persons on board makes with the number and classification recorded upon the consular or other bill of health. The apparent presence or absence of quarantinable disease is the most that can be determined by a single and perhaps cursory examination of a large number of passengers mustered especially for the occasion. Instances are rife where careful and conscientious quarantine officers have failed to detect cases of quarantinable disease in passengers who by means of careful planning were able to evade inspection. For example, a case of smallpox in the steerage of a vessel was successfully concealed for ten days from a ship's surgeon who was known to be very careful in his work. The case was discovered in hiding by one of three quarantine officers who searched the steerage of the vessel after

every one in sight had been sent to muster on the upper deck. It was found that the steerage passengers, upon learning that one of their number was suffering from smallpox, had concealed the man in order to escape the detention at quarantine which they knew would follow his detection. On another occasion a mess man suffering from bubonic plague was discovered during muster. The man had a temperature of 39.3° C., and a characteristic bubo, in the serum from which plague bacilli were shortly afterwards demonstrated. There is also a case on record of a sailor who while standing in the muster line waiting for inspection, turned aside and vomited black over the rail of the vessel. A cross-examination showed that he had been induced to leave his bunk only for the time being, the fact of his suffering from yellow fever being known at least to the captain of the vessel. These examples of "concealed infection" are cited to show that only the presence, not the absence, of quarantinable disease on board of a vessel can be determined as a fact when the evidence is based solely on the single inspection of a vessel made at the end of the voyage. In other words, the absence of quarantinable disease under these circumstances must always be classed as a supposition, not a fact.

The facts furnished by the type of vessel depend greatly upon the ease with which the hull itself may be inspected. In the modern ocean carrier more than ordinary attention is given to the condition of the hold, the keelsons, and the spaces under the dunnage planks. In such vessels inspections are not attended with great difficulty, as the passageways and holds are fairly well lighted. In the old type vessels, and especially in the case of tramp steamers, the condition of the hull can be determined, but only with more or less difficulty and personal discomfort to the quarantine officer. From the nationality of a vessel some idea of the degree of care necessary in determining the fact of cleanliness or uncleanliness may be had.

The nationalities represented by the passenger lists are elements which are accessory to facts. For example, Anglo-Saxon emigrants from the country districts are much more likely to be infected with quarantinable disease than those from the large cities, the reason for this being that vaccination is practiced more extensively in cities than in the country, and the city inhabitants of the emigrant class, having been exposed so constantly to all of the infectious and contagious diseases, possess an acquired immunity. Chinese coolies know by instinct when plague or the "black sickness" is among them. Their fear of the disease and their desertion of their sick when this disease is present may be taken into consideration as a fact against passengers of their nationality attempting to hide a case of plague occurring in their midst. On the other hand, the Chinese do not fear smallpox and they know nothing of yellow fever.

The Japanese, with their usual stoicism, disclose to the quarantine officer little or nothing where quarantinable disease is present among them. As a class they are well vaccinated and are clean of person. The Koreans are usually dirty of person, stupid as a class, and should be taken always as a risk.

The judgment of a vessel's status, if founded upon facts observed, must be determined solely in the premises outlined above. It happens, however, that other considerations force themselves upon the attention of the quarantine officer. These are conditions which the public at large imposes. The public cares not how many or how few facts the quarantine officer has at his disposal to guide him in his decision as to the sanitary status of a vessel. The quarantine officer is expected to render this decision immediately after his inspection of the vessel, and the said decision is expected to afford protection to the community and yet act as a sanitary sieve, not as a dam, to commerce. If the quarantine officer only had the facts above enumerated to consider, an opinion would always be prompt and, generally speaking, exact, but the probability of latent or concealed infection to which a large steamer, en route perhaps ten days from an infected port, is liable, renders a decision possible only after the consideration of the following conditions: First, the probable sanitary history of the voyage; second, the likelihood of latent infection; third, the personality of captain of the vessel; fourth, the likelihood of concealed infection; fifth, the attitude of the ship's surgeon; sixth, the kind of cargo carried.

The probable sanitary history of the voyage.—The probable sanitary history of the voyage involves the hazard of way-port traffic. For example, if 100 coolies of unknown origin board a vessel in Hongkong and leave her two days later at Shanghai, their presence on board may or may not have altered her sanitary status, but the number, nationality, and destination of the coolies, together with the general known sanitary condition of the port, would raise a question which might be used as collateral to facts. As a case in point, 70 Chinese sailors were once taken on board of a vessel at Hongkong, which vessel was destined to San Francisco via Shanghai, the Japanese ports, and Honolulu. At Nagasaki, five days later, the coolies were transferred to another vessel. Two days after their transfer one of the sailors died with bubonic plague. In the meanwhile the first steamer had sailed for Yokohama, and at the latter place the medical officer of the Public Health and Marine-Hospital Service learned of the incident and was able to report it to Honolulu. As no further case of disease had appeared on the passenger vessel the quarantine officer at Honolulu would have rated the probable sanitary history of the voyage as good, had he not received the information as stated above from the medical officer at Yokohama.

The likelihood of latent infection must be reckoned with, particularly in the case of such diseases as yellow fever or plague. Latent infection in the case of plague could be caused by an infected rat carrying infected fleas being introduced into a vessel with the freight. The following case illustrating latent infection occurred in a tramp steamer leaving Hongkong for San Diego via Honolulu. On the eighteenth day out of Hongkong, or three days before reaching Honolulu, a Chinese sailor died. He had been sick only two days prior to his death and throughout his illness lay in a stupor. It was thought that he was under the influence of opium, as he was greatly addicted to the use of the drug. Upon the arrival of the vessel at Honolulu the vessel was placed in quarantine on account of the sanitary history of the voyage. The captain denied ever having seen dead rats on board, and a daily examination of the crew showed them to be apparently in good health. The vessel, which carried freight for San Diego, Cal., could not be disinfected at Honolulu for the purpose of destroying rats and vermin, so she was allowed to sail for San Diego, after having been detained for eight days in quarantine at Honolulu, but all of the facts in the case were reported to the quarantine officer at San Diego and he was advised to disinfect the hold of the vessel upon her arrival there. On the fifth day out on the voyage to San Diego, thirteen days after her arrival at Honolulu and sixteen days after the death of the sailor, five deaths occurred, which even the captain upon his arrival at San Diego was convinced were from plague. The quarantine officer at San Diego noticed many dead rats in different parts of the vessel.

Latent infection with yellow fever could be caused by infected mosquitoes gaining an entrance into the hold of a vessel along with the freight or else by noninfected mosquitoes being present on the vessel and becoming first infected and afterwards infective from a mild or unrecognized case of yellow fever occurring on the voyage. Such infected mosquitoes might infect nonimmune stevedores at the port of arrival, or persons having residence contiguous to the shipping.

The personality of the captain of the vessel.—In the practice of quarantine, as in all phases of life, the personal equation must come in for consideration. The commander of a vessel is practically a king ruling over a floating world. People unconsciously look the second time at the "captain"—his ability, his knowledge, his courage, his probity are the qualities which they would know more about. In traveling on vessels passengers listen with attention to what the captain has to say, and soon opinions as to his general worth both as an officer and a man are formed. These opinions may be of small value from a technical point of view, but on the whole the composite opinion formed would describe the man with a fair degree of accuracy. While the world at large has admiration for the big-hearted, courage-

ous sailor, it only has respect in these progressive days for the sailor who adds to these desirable qualities those of education and breadth of mind. When fair-minded people hear the commander of a large ocean carrier speak in terms of denunciation of quarantine as an institution, an impression is certain to be formed that the said commander would through the fullness of his ignorance deny to his owners and his passengers and crew that sanitary protection which the whole medical world has pronounced necessary for the public good, and for which the whole people are annually contributing. That the quarantine officer should consider the master of the vessel as a factor in determining its status is but one of the signs of these progressive times. It is pertinent here to add that the time is coming, and quickly, too, when those commanders who lend the most aid to quarantine work and sanitary science will be the ones who will be placed on the largest vessels and on the most important runs, for the vessels offering the greatest safety to passengers and to communities will earn the greatest dividends for their owners.

The attitude of the ship's surgeon.—The attitude of the ship's surgeon is usually what the ship's owners make it. Some owners desire their surgeons to confine their attention solely to the treatment of the sick on board their vessels. Other owners instruct their surgeons to study the quarantine laws and apply them to the prevention of quarantinable diseases on board their vessels. All owners would have quarantine officers accept the statements and diagnoses of their surgeons, and all surgeons consider quarantine officers devoid of professional courtesy when they fail to accept such statements and diagnoses. The owners and the ship's surgeons are both wrong for the following reasons: First, the quarantine officer and not the ship's surgeon nor owner is the person directly responsible to the community for the sanitary condition of a vessel; second, the quarantine officer, on account of his experience with quarantinable diseases, is a far better judge than the ship's surgeon is likely to be of the many ways in which infection may manifest itself.

It is plain that the attitude of the ship's surgeon must be the one of witness. He must answer all of the quarantine officer's questions from the standpoint of a physician, but like a hospital interne he should not advance an opinion nor expect the quarantine officer to be influenced by it when advanced, for the reason above stated that it places the ship's surgeon in a partisan light. As a physician it is more proper and dignified for him to be neutral. But all ship's surgeons are not neutral; therefore the attitude of the ship's surgeon may be a factor to be reckoned with—the quarantine officer must judge of this.

The character of cargo carried.—A cargo is dangerous according to its general character. Coal, oil, ore, nitrates, and phosphates are

usually safe cargoes, while flour, cereals, grain, and foodstuffs are apt to harbor vermin, and are therefore open to question. General merchandise is dangerous, but principally because the spaces which usually intervene between the parcels may harbor vermin. A vessel may be found a safe risk in every other respect save in her cargo. A decision depending upon the status of the cargo is always a difficult one to make, as on the one hand the public health may suffer and on the other hand the vessel may be put to needless expense. After all, the quarantine officer must judge cargoes by the probability of their affording a habitat for intermediate hosts. For instance, coal and nitrate cargoes harbor very few if any rats. On the other hand, cargoes of foodstuffs, rice, flour, and the like are apt to harbor rats in large numbers. In deciding the status of a vessel the character of the cargo must be considered, and usually where the quarantine officer is not familiar with the conduct of the vessel at the loading port, the cargo must serve to discount the pratique rendered. For example, a large ocean carrier, having had a case of plague on board in the person of a Chinese fireman, which case was plainly chargeable to infection received on board ship, was detained for ten days in a foreign port and the usual disinfection performed in a manner which the medical officer of the Public Health and Marine-Hospital Service stationed in the said foreign port, certified as efficient save in one respect, and that was that not sufficient cargo had been removed to make it certain that many of the rats on board had been killed, and that all of those killed had been found. After the disinfection and detention, the vessel was given more cargo, but no mention was made as to whether the proper precautions were taken to prevent fresh ingress by rats. Upon arrival at the American port the pratique was modified to provide for a redisinfection of the vessel. After the disinfection by the "layer" method, which consists of disinfection after removing a layer of cargo 6 feet deep, the process being repeated until all of the cargo is out of the vessel, it was found that besides many rats which were mummified, there were many rats which had been only recently killed. Now, the question that at once arose was whether the rats newly killed came on board the ship with the new freight at the last port or whether they had lived through the first disinfection. It is reasonably certain that either explanation would have been sufficient so far as the elements of possibility and probability were concerned. The quarantine officer was suspicious of the vessel because her cargo was not a compact one, being composed of much bamboo ware, which is shipped lightly crated and in the hollow spaces of which rats can and do live.

A cargo of flour, rice, and sugar, if built up in a compact mass from the dunnage boards, does not furnish sacculated cavities or breathing spaces in which rats can live. It will be seen

FIG. 7.—A MUSTER OF ORIENTAL PASSENGERS PRIOR TO THE DISINFECTION OF BAGGAGE

from this brief synopsis of the many points to be considered in arriving at a conclusion as to the sanitary status of a vessel, that the home port inspection furnishes many more suppositions than facts. Therefore, the judgment of a vessel's status can only be obtained by a process of deduction, and the most successful quarantine officer is the one who forms the largest number of correct deductions.

The inspection and judgment of vessels in ballast.—The inspection of a vessel in ballast from suspected or infected ports should include a personal scrutiny of every accessible part of the hold. Vessels carry either water or hard ballast. Water ballast is carried in tanks arranged especially for the purpose. Water obtained from rivers or lakes where cholera, typhoid, or dysentery prevails is dangerous, while sea water may be considered safe. Hard ballast may consist of stone, sand, dirt from excavations, loam, and street sweepings. Unless ballast consists of hard rock or dry, clean sand, or sea water carried in ballast tanks, or otherwise unless it is certified to by an officer of the Public Health and Marine-Hospital Service as having been obtained in an uninfected locality, it should be discharged in deep water in the case of hard ballast, and pumped out into deep water in the case of water ballast.

An inspection of the hold will show whether the air streaks are sufficient, whether the bilges are in good condition, whether the spaces along the keelson and along the frames are free from rubbish or filth, whether the anchor chains have been washed free from mud, and whether the sanitary condition of the chain lockers is satisfactory. The general condition of the hold may be determined also by the sense of smell.

QUARANTINE TREATMENT.

In maritime quarantine work suspected or infected vessels, together with all persons and effects on board, are subject to what is known as quarantine treatment. Quarantine treatment comprises, first, the treatment of the sick; second, the management of persons occupying cabin quarters; third, the management of steerage passengers and crew; fourth, the treatment of baggage and personal effects; fifth, the treatment of the hull or vessel proper.

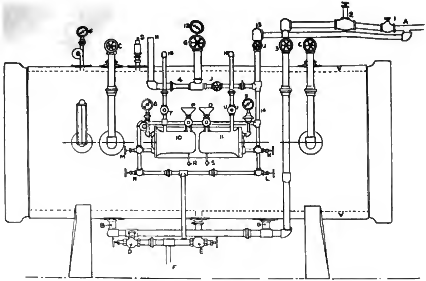
The treatment of the sick.—As soon as the vessel is brought alongside the quarantine station pier, the work of removing the sick is begun. The physical condition of one or all of those sick may not admit of such removal, and this point must be considered and decided by the medical officer. This applies to yellow fever during the second stage, or stage of remission, to cholera during the stage of collapse, and to smallpox during cold or inclement weather if the fever of eruption be present. A person suffering from a quarantinable disease, during the process of removal, should be carried in a stretcher,

the latter, together with the body and head of the patient, to be completely enshrouded by a clean sheet or binder of muslin. The sick, together with their effects are taken direct to the lazaretto without disinfection. The room occupied by the patient should be disinfected by means of sulphur in pots immediately after it is vacated.

The management of persons occupying cabin quarters.—In this class are included the first and second cabin passengers and those ship's officers who are accorded similar accommodations. These passengers are taken off in numbers corresponding to the capacity of the steam-disinfecting chambers. The ordinary 9-foot disinfecting chamber will handle on an average 12 cabin passengers an hour, therefore two of these chambers will disinfect the baggage of 24 cabin passengers an hour. The baggage from the staterooms, should it require disinfection, should be placed in gunny sacks and checks given for identification. The gunny sacks with their contained clothing are then placed in the steam chambers and disinfected. After the first cabin passengers are disposed of the second cabin passengers are treated in a similar manner. The cabin passengers are directed to their quarters on the station as soon as the disinfection is completed. The ship's dirty linen should be carefully gathered together and re oved for disinfection. As soon as the first and second cabin quarters are vacated, the disinfection of said quarters should be immediately begun. A small cooking pot containing the requisite amount of sulphur, the pot having been placed in a pan containing water, is set in each stateroom and fired and the door and window or port sealed up with mucilaged paper strips. The metal fixtures and gilt work in the staterooms should be greased with vaseline for protection against the action of the sulphur dioxid.

The management of steerage passengers and crew.—The steerage passengers are taken from the vessel as soon as the disinfection of the second cabin passengers is completed. Passengers of this class should be taken from the vessel in groups of 24, as the baggage of that number can be disinfected every half hour by two ordinary steam chambers 9 feet long. Should the capacity of the chambers be doubled, the number of passengers to be handled may be correspondingly increased. The baggage of the steerage passengers should be checked after it is properly arranged in the gunny sacks. While the steerage passengers are being removed their living quarters and the hatches leading to the holds should be prepared for disinfection by sulphur gas. The quarantine officer should obtain the assistance of the crew of the vessel in this important work.

Finally the personnel of the vessel is removed, the engineer's department first, then the steward's department, and finally the deck department. As each set of quarters is vacated and emptied, the sulphur pans are set and the compartments are rendered air-tight.



Kinyoun-Francis Disinfecting Chamber

1 Valve admits steam from boiler to reducing valve. 2 Reduces steam to pressure used in chamber. 3 Valve admits reduced steam to jacket at bottom. 4 Vacuum apparatus. 5 Safety valve. 6 Steam pressure gage. 7 Thermometer. 8 Formaldehyd pressure gage. 9 Ammonia pressure gage. 10 Copper formaldehyd retort. 11 Steel ammonia retort. 12 Vacuum gage. 13 High-pressure steam pipe to vacuum apparatus. 14 Branch to formalin and ammonia retorts. 15 Copper pipe conducts formaldehyd gas to chamber. 16 Iron pipe conducts ammonia gas to chamber. A Steam pipe from boiler. B, B Steam pipes to jacket. C, C. Valves admit steam from jacket to chamber. D Drip valve from jacket. E Drip valve from chamber. F Outboard drip and circulation. G Vacuum valve. H Exhaust pipe of vacuum apparatus. J. Valve admits high-pressure steam to vacuum apparatus. K Valve admits high-pressure steam to ammonia coil. L Drip from ammonia coil. M Valve admits high pressure steam to formaldehyd coil. N. Drip from formaldehyd coil. O. Filler for ammonia retort. P Filler for formaldehyd retort. R Drain from formaldehyd retort. S. Drain from ammonia retort. T Valve admits formaldehyd gas to chamber. U Valve admits ammonia gas to chamber. V The steam jacket.

FIG. 8.—DIAGRAM OF DISINFECTING CHAMBER (SIDE VIEW).

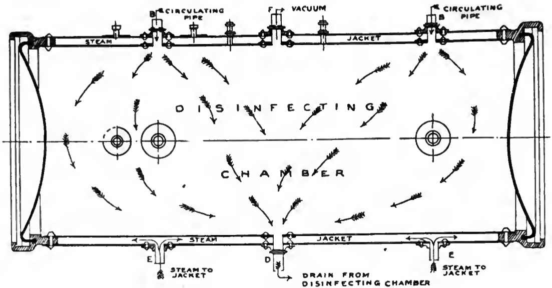


FIG 9.—LONGITUDINAL SECTION THROUGH STEAM DISINFECTING CHAMBER

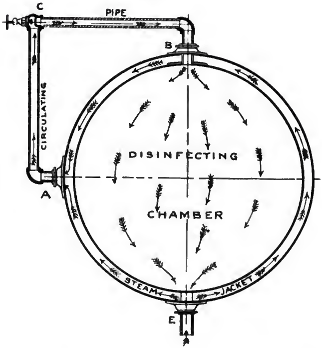


FIG. 10.—CROSS-SECTION THROUGH STEAM DISINFECTING CHAMBER

The crew are treated in a similar manner to the steerage passengers. As soon as the disinfection has been performed, both steerage passengers and crew are marched to the detention quarters at the quarantine station.

The treatment of baggage and personal effects.—Baggage and personal effects are disinfected by means of steam in steam chambers with or without formaldehyde.

The disinfection of fabrics, clothing and bedding in quarantine practice is usually accomplished by the use of either steam or formaldehyde in the Kinyoun-Francis steam chamber.

The Kinyoun-Francis steam chamber may be used with jetting steam or steam under pressure; with formaldehyde gas alone or in combination with dry heat; and also with a combination of these methods with or without a vacuum. The chamber is built of an inner and an outer shell. The steam jacket when heated prevents the condensation of steam in the disinfecting cylinder by heating the latter before the steam is turned in. This prevents the wetting of the clothes or other articles to be disinfected. In using the chamber with steam, either with or without pressure, the steam is kept continuously coursing through the jacket.

Loading the chambers.—The chambers must be loaded with care. The clothes should be hung up in the disinfecting cars and under no circumstances stuffed in. Clothes are usually loosely arranged in wire baskets or gunny sacks, which are then neatly arranged in the disinfecting car. The baskets or gunny sacks are numbered with metal checks with duplicates, the latter to be held by the owner of the baggage during the process of disinfection. All clothes should be protected from rust from the wire of the baskets and of the racks of the disinfecting cars by lining such wire surfaces with thin muslin. The thin burlap bag is also very useful in keeping the baggage of different persons separate and in affording it protection from the drip of condensed steam and from the rust from contact with wire or other metallic surfaces.

DIRECTIONS FOR OPERATING THE STEAM CHAMBERS.

(From the Annual Report U. S. P. H. and M. H. S., 1899.)

Steam disinfection.—(*a*) The chamber being cold, steam is admitted through the reducing valve 2 to the jacket *v*, care being taken to admit it very slowly at first to prevent sudden expansion and possible damage to chamber. Steam pressure must never exceed 10 pounds per square inch in either jacket or chamber.

(*b*) A proper temperature being obtained in the jacket (212° to 240° F.), the infected goods loaded in the car are pushed into the chamber, the doors are closed and made steam tight by means of the hand wheels.

(*c*) As soon as the temperature in the chamber is nearly as high as that in the jacket the exhauster is started and a vacuum of about 15 inches produced in the chamber, the exhauster being then shut off.

... gas from the ammonia retort is admitted to the chamber to neutralize the ... effects of the formaldehyde gas. Only a small quantity at low pressure is required. The method of operating the ammonia retort is exactly the same as that for the formalin retort, excepting that commercial aqua ammonia

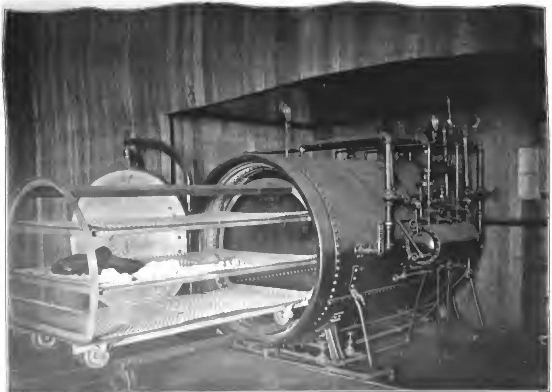


FIG. 11.—A STEAM CHAMBER PROPERLY INSTALLED ("INFECTED" END).

(*d*) By means of the circulating pipes A C B steam is very slowly admitted to the chamber from the jacket, the pressure in the chamber gradually raising to equal that in the jacket.

(*e*) The circulating pipe valves are now shut off and operations (*c*) and (*d*) repeated, after which the goods in the chamber are left exposed to steam at about 10 pounds pressure for a period ranging from fifteen to thirty minutes, depending on the character and compactness of goods being treated. The object of repeating operations (*c*) and (*d*) is to secure penetration and a high temperature (say, 230° F.) in the interstices of the exposed goods by means of the transmission of heat by the moisture from the steam and the removal of air by the exhauster.

(*f*) After the exposure the steam is shut off from the chamber and the vacuum again produced, all steam and moisture being carried off and the goods being thoroughly dried by heat from the jacket.

(*g*) Air is then admitted by opening the exhauster discharge valve, the doors are opened, and the car and goods removed. No articles such as leather or books, which may be injured by steam heat, are exposed to this process.

Operation of formaldehyde disinfection.—In the retort marked "Formalin" is poured the desired quantity of the formalin mixture which is usually prepared under the following formula: 1,000 parts (by volume) of formaldehyde (H.CHO) 40 per cent strength; 200 parts (by volume) of calcium chloride ($CaCl_2$); 400 parts (by volume) of water (H_2O).

The calcium chloride is dissolved in the water and filtered, after which the formaldehyde is added. This mixture is poured into the retort and all valves closed. To generate the gas the valve to the steam coil is opened and the heat will cause rapid vaporization. The pressure on the retort, as shown by the gauge, should never be allowed to exceed 40 pounds. When this pressure is nearly reached, the apparatus is ready for use.

The steam chamber being filled with goods to be treated with formaldehyde, and operations (*a*), (*b*), and (*c*), (as for steam) having been performed, the valve in the pipe connecting the formaldehyde retort to the chamber is opened very slightly (to avoid lifting the liquid in the retort by the vacuum in the chamber) and the gas is allowed to pass into the chamber until the pressure in the retort drops to nearly zero. The remaining liquid in the retort is again heated by the steam coil and, as before, when the pressure is nearly 40 pounds the gas is admitted to the chamber. It is usually necessary to heat the retort two or three times before the chamber is entirely filled with the gas.

The amount of formalin required can be computed by consideration of the volume of the chamber. One liter (61.0271 cubic inches) of formalin will evolve about 1,450 liters of the gas. The volume of one chamber is 435,951 cubic inches and that of the retort 1,526.64 cubic inches, the ratio being such that if the retort is one-fifth filled with formalin originally it will entirely fill the chamber with the gas, provided all the formalin is vaporized.

In case the goods being treated are such as would be damaged by a dry heat of more than 100 degrees (as leather goods), operations (*a*), (*b*), and (*c*) are so modified as to keep the temperature as desired; that is, only enough steam is admitted to the jacket to slightly warm it.

After the goods are exposed for the proper time to the formaldehyde gas (the time varying from ten to twenty minutes, according to the nature and density of goods being treated), the retort valve is shut off and operation (*f*) proceeded with.

Then ammonia gas from the ammonia retort is admitted to the chamber to neutralize the irrigating effects of the formaldehyde gas. Only a small quantity at low pressure is required. The method of operating the ammonia retort is exactly the same as that for the formalin retort, excepting that commercial aqua ammonia

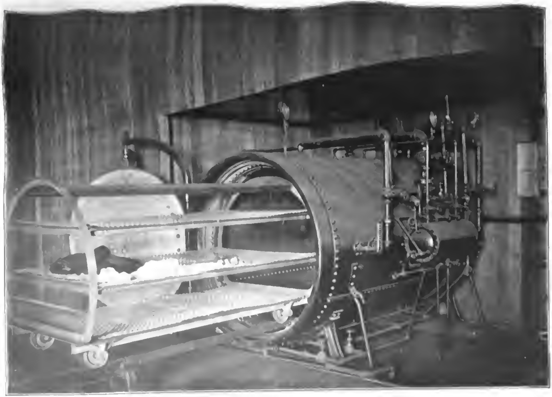


FIG. 11.—A STEAM CHAMBER PROPERLY INSTALLED ("INFECTED" END).

is used. After exposure to this gas for about three minutes, operation (*f*) is repeated, and then operation (*g*) is proceeded with.

The disinfection of the hull or vessel proper.—The disinfection of a vessel requires on the part of the disinfector some familiarity with the general arrangement of the interior of vessels and a certain amount of ingenuity. A vessel is seldom so badly infected as to require disinfection throughout. The hazard of an infected vessel varies according to the nature of the disease with which it is actually or presumably infected. Therefore it is frequently very difficult to decide just what parts of a vessel and just what personal effects should be disinfected. There is no reason why the staterooms of the first-cabin passengers should be disinfected because there is a case of smallpox in the steerage or in the quarters of the crew. Likewise there is no reason to disinfect the hold of a vessel and break the cargo in bulk because of a case of smallpox, cholera, or typhus fever in the cabin or steerage. Therefore an infected vessel requires definite and especial quarantine treatment according to the nature of the disease with which it is infected. For example, in vessels infected or suspected of infection with cholera, especial attention must be paid to the drinking water on board, and the vegetables and fruits as well. In the case of plague the destruction of rats and other vermin is of first importance. For yellow fever, measures must be taken against the presence of stegomyia mosquitoes, and for smallpox and the eruptive fevers the usual disinfection of living apartments, clothing, bedding, and the personal effects of those exposed to infection is required. After the quarantine officer has made a thorough inspection of the vessel he can determine the exact extent to which he will carry the process of disinfection. Such rooms as the carpenter shop, chain lockers, rope and sail lockers, lamp lockers, paint rooms, chart room, pilot house, engine and boiler rooms, machine shop, shaft alleys, and turtlebacks are usually not infected, and therefore require no disinfection. It may be necessary, however, to fumigate these places for the destruction of rats and mosquitoes. The dining saloons, social halls, and smoking rooms usually contain a great deal of metal and gilt decorations, which are ruined by sulphur; therefore, the metal and gilt work in such compartments, when fumigation is required, should be protected by a coating of vaseline. Any portion of a vessel which is dirty and which requires mechanical cleaning should be ordered cleaned at once before the regular work of disinfection is begun. The principal agents used in the disinfection of the vessel proper are sulphur dioxide, formaldehyde gas, and bichloride of mercury.

SULPHUR DIOXIDE.

Sulphur dioxide is the most efficient of all of the disinfectants so far as the holds of a vessel or compartments are concerned. It is equally destructive to animal and vegetable life, and is therefore invaluable in quarantine practice in destroying contagion that is transmitted through the agency of mosquitoes, fleas, bed bugs, rats, and mice. Its action requires the presence of moisture in some form. The gas diffuses slowly and has very little penetrating power. Therefore the use of sulphur gas should be limited to the disinfection of surfaces, it being unsuitable for the disinfection of bedding, mattresses, and fabrics. It does not kill spores, and is therefore inapplicable to diseases caused by spore-forming organisms. It should be borne in mind that sulphur gas bleaches all fabrics colored with vegetable dyes, and has a disintegrating action upon cotton and jute fabrics, such as sugar and fertilizer bags.

METHOD OF COMPUTING THE AMOUNT OF SULPHUR REQUIRED FOR THE DISINFECTION OF HOLDS AND COMPARTMENTS OF VESSELS.

One pound of sulphur burned in a space containing 1,000 cubic feet will produce 1 per cent of the gas. Five pounds of sulphur burned in a space containing 1,000 cubic feet will produce 5 per cent of the gas. This latter volume strength of gas is sufficient to kill all nonspore-bearing organisms after sixteen hours' exposure. With 2 pounds of sulphur for every 1,000 cubic feet, two hours' exposure is sufficient to kill mosquitoes and vermin.

In computing the capacity of the hold of a vessel for the purpose of determining the number of thousand cubic feet of space therein, and therefore the number of pounds of sulphur which will be required to produce a 5 per cent volume of the gas, the net tonnage of the vessel indicates in a general way the cubic capacity of her cargo-carrying space. Ten net tons will represent 1,000 cubic feet of space; therefore, for every 10 net tons 5 pounds of sulphur must be used to get the approximate 5 per cent volume strength. The capacity of the living apartments, storerooms, and the like had best be computed separately.

THE SEALING OF HOLDS AND COMPARTMENTS.

In disinfecting with sulphur gas all spaces must be rendered airtight. In disinfecting the holds of vessels the hatches should be covered over with their regular waterproof tarpaulins and tightly battened down, leaving a vent for the escape of the sulphur. All air streakes, scuttles, and chain ports should be closed. The doors should be sealed by means of strips of paper pasted over the intervals left between the frame and the door.

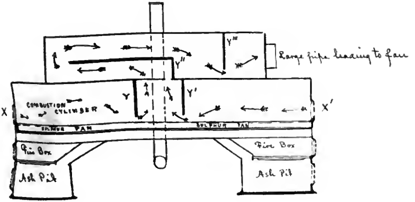


Diagram of sulphur furnace used by the U.S. Public Health & Marine Hospital Service.

FIG. 12.

FIG 13.—SHOWING SULPHUR PAN IN POSITION, ALSO AUTOCLAVES AND HAND BICHLORIDE PUMP

SULPHUR FUMIGATION.

In quarantine practice sulphur fumigation is usually effected by the combustion of sulphur either in furnaces especially constructed or designed for the purpose or in ordinary iron pots. Sulphur either in the form of flowers of sulphur or roll sulphur is suitable for the purpose.

THE SULPHUR FURNACE.

The sulphur furnace adopted by the Public Health and Marine-Hospital Service is shown in Fig. 12. A thin layer of sulphur is spread upon the sulphur pan, the sulphur being introduced through the doors X and X′ at both ends of the combustion cylinder of the furnace. These doors are provided with openings or dampers through which the air passes over the burning sulphur, and by which the amount of air entering the combustion cylinder is regulated. Only enough air should be admitted to keep the sulphur burning with a low blue flame, as a draft will only carry over molten sulphur which will sublime on cooling and clog up the pipes. The sulphur fumes pass around the break plates Y, Y′, Y″, and Y‴, as shown by the arrows in the drawing, in order to make the combustion of the sulphur complete, or in other words, to complete the combustion of the oxygen in the air, forming SO_2, or sulphur dioxide or sulphur gas. After passing the last break plate Y‴ the fumes enter the large pipe leading to the fan, the latter serving to aspirate the fumes from the combustion cylinder to the hold of the ship or other place to be fumigated. The fan, which is usually placed close to the sulphur furnace, is run by an engine, the governor of which should be set to allow not more than 350 revolutions of the fan to the minute, otherwise the oxygen of the air will not all be combined, with the sulphur, into sulphur dioxide. Running the fan at a speed higher than that mentioned above will also cause overheating of the sulphur pipes, and perhaps by the carrying over of sparks cause a fire to break out in the hold of the vessel. This rule should be strictly observed by medical officers. After counting the revolutions of the fan by means of a speed indicator, one learns to tell at a glance whether or not the fan revolutions are in excess of 350 to the minute. After the sulphur gas passes through the fan it is conveyed into the hold of the vessel through galvanized iron or composition rubber pipes made for the purpose. The pipe is carried through a small hole especially made in the hatch covering by means of a small saw, and then let down into the hold of the vessel until it is near the bilge. Sulphur gas, being heavier than air, collects at the bottom and gradually ascends, so that it is important to leave an opening in the hatch covering for the exit of the air near the top. This opening should not be closed until sulphur gas begins to escape freely. During the

disinfection of a hold of a vessel or compartment vapor should be supplied by a steam jet run through flexible steam hose from the boiler, or else a few buckets of water should be placed in the ship's hold.

SULPHUR DISINFECTION BY THE USE OF POTS.

Almost any kind or size of iron pot will answer the purpose. The ordinary sugar pan 2½ feet in diameter is useful in disinfecting the hold of a vessel or a large compartment, the number of pans to be determined by the number of thousand cubic feet of area to be disinfected. Not more than 30 pounds of sulphur should be placed in each pot. For the disinfection of staterooms and the like small iron cooking vessels are suitable. Each pot should always be placed in a tub of water, as shown in the illustration. The tubs should be made of wood or compressed paper, as tubs made of galvanized iron or composition metal deteriorate rapidly through rust or breaks in the seams. The pots should never be placed on the floor of a compartment or bottom of the hold of a vessel. In compartments or rooms they should be placed upon tables or chairs, and in the holds of vessels either on the "tween" decks, upon piles of ballast, or upon improvised stands. The sulphur should always be ground or mashed into a powder before being placed either in the pots or in the sulphur furnace. In using the sulphur in the furnace the former may be spread out evenly or flat upon the sulphur pan, but in pots the sulphur should be piled around the sides with a central depression or crater. Alcohol should always be used for lighting sulphur, although a hot coal will answer the purpose.

FORMALDEHYDE GAS.

In quarantine practice this gas is most conveniently and efficiently used by means of the autoclave. By the use of the autoclave the gas is produced from its solution under pressure, and not only is the gas evolved in a very short time, but good penetration and diffusion is obtained. The autoclave consists of a copper retort constructed to withstand the required pressure. The retort is provided with a filling funnel, a water gauge, a pressure gauge, and a small outlet pipe, to which a long copper tube may be screwed, said long tube being small enough to be introduced through the keyhole of a door. The retort is also provided with a safety valve to prevent accidents. The heat is supplied by means of the ordinary Primus lamp. The solution used consists of formalin, 40 per cent, with 20 per cent of calcium chlorid, or some other neutral salt such as common table salt. Ten ounces of the solution should be used for each 1,000 cubic feet of space to be disinfected. The retort usually holds 1 liter of the solution, enough for the disinfection of 3,000 cubic feet of air space. In using the autoclave fill the retort, close all valves, light the lamp,

and bring up the pressure by degrees. Open the outlet frequently as the pressure rises in order to drive out the heated air. When the pressure reaches 45 pounds, open the outlet valve and permit the gas to enter the compartment to be disinfected. With the pressure maintained at 45 pounds, it will require about twenty minutes to evolve the gas from the liter of the solution. After the formaldehyde gas has escaped within the compartment the steam from the retort should be allowed to enter the compartment in order to furnish the moisture necessary for the maximum disinfecting power of the gas. The retort should be charged separately for each compartment to be disinfected. A compartment disinfected in this manner should be left sealed and exposed from three to twelve hours. Fabrics and clothes hung up loosely in a compartment may be disinfected at the same time, but the exposure should last for twelve hours.

BICHLORIDE OF MERCURY SOLUTION.

A large quantity, at least 2,000 gallons, of a solution of bichloride of mercury, of the strength of 1 to 1,000, should be kept on hand at every quarantine station ready for immediate use. Bichloride of mercury dissolves in 16 parts of cold water and 3 parts of boiling water.

The solubility of the bichloride will be increased by either using sea water or adding sodium chloride to the fresh water in the proportion of 2 parts to 1,000. In making the solution a gallon of water may be made to approximately represent 4 liters, so that for every gallon of sea water 4 grams of bichloride should be added; therefore 50 gallons of solution would require 200 grams, or about 7 ounces, of bichloride; 1,000 gallons of solution, 4,000 grams, 4 kilograms, or 8.8 pounds, of bichloride; and, finally, 5,000 gallons of solution, the amount which should be constantly on hand at a quarantine station, would require 44 pounds of bichloride of mercury. This solution should be stored in 2,000-gallon wooden tanks placed at a high elevation in order to obtain pressure. It is better, however, that a steam pump be provided for the purpose of giving the solution the proper force when used in the holds of vessels, particularly those of wooden vessels in which there are many cracks and crevices which should be thoroughly treated with the solution. The steam pump should have a 2-inch suction pipe with a 1½-inch discharge. The water end should be made of iron and the nozzles and spray ends of hard rubber. After using the pump it should be washed out by means of a standpipe running for this purpose into the separator. The hose used should be 1½ inches in diameter, and should be provided with a combination straight and rose-jet nozzle. The straight nozzle is intended for use in spraying cracks, crevices, and irregular surfaces. For mixing the solution it is convenient to have on hand several packages of

finely powdered bichloride of mercury weighed out in the amount, or in the multiples thereof, necessary for the solution required, as judged by the capacity of the tank.

The solution may be mixed in concentrated form, using sea water for the purpose, and then added to the big tank, or else mixed in the latter by placing the bichloride in a box perforated by fine holes, the said box, into which the feed pipe is carried, being suspended over the tank. In other words, the sea water is made to percolate through the bichloride in the perforated box.

The disposition of a vessel after disinfection.—The disposition of a vessel after the complete disinfection of her hull depends upon whether it is desired to detain the personnel on board or at the quarantine station. After the hull of a vessel has been disinfected there is no reason why the vessel itself should not be allowed to proceed to port in charge of a clean crew, the personnel remaining at the quarantine station during the detention period required. Should it be necessary to detain any or all of the personnel or passengers of the vessel on board, the vessel is ordered to a specified anchorage. During the period of detention all hands on board should be inspected morning and afternoon. If the period of detention passes without the further appearance of quarantinable disease, the vessel is given pratique. In the event of the reappearance of disease, the whole process of disinfection and detention must be gone through again, the detention dating from the completion of the last disinfection.

THE HOUSING AND SUBSISTING OF PASSENGERS AND CREW.

The passengers and crew are assigned to quarters in groups or detachments immediately upon the completion of the disinfection of baggage, if the latter process be required. The quarantine officer is then expected to provide for, satisfy, and control several large, and from a social standpoint, widely separated groups of people. In other words, he must conduct a small first-class hotel, a second-class hotel, a third-class hotel, and if there are Orientals to be detained, a large oriental camp. Each group of persons must be fed and served in a degree at least comparable with what they have recently become accustomed to on board the vessel. The cabin passengers must be induced to limit as much as possible the amount of baggage to be taken to the quarters. They must be assigned to rooms as far as possible with reference to their preferences regarding their shipmates. It is needless to say that the cleanly and orderly condition of the floors, windows, china ware, beds, and linen in the rooms must be such as to at least silence criticism if not to evoke some measure of praise. This same state of affairs should also prevail in the dining room and kitchen.

In providing for the subsistence of first-cabin passengers, the following meal schedule and the daily subsistence requisitions covering it are given as an aid in making quick provision for passengers of the cabin class. The daily subsistence requisitions provide for 20 cabin passengers.

Bill of fare, quarantine station.

Breakfast.	Dinner.	Supper.
	SUNDAY.	
Mush and milk.	Cream and celery soup.	Cold meats.
Ham and eggs (2).	Chicken fricassee.	Potato salad.
Baked potatoes.	Mashed potatoes.	Boiled potatoes.
Rice.	Roast sweet potatoes.	Rice.
Buckwheat cakes.	Corn.	Canned fruit.
Maple sirup.	Tomato salad.	Cake.
Orange.	Sweet pudding, with lemon sauce.	Tea.
Coffee.	Coffee.	
	MONDAY.	
Mush and milk.	Soup.	Cold meats.
Mutton chops.	Pot roast.	Fried salmon.
Fried potatoes.	Brown potatoes.	Fried potatoes.
Rice.	Creamed cabbage.	Rice.
Yeast biscuits.	Beet salad.	Vermicelli and cheese.
Honey.	Apple dumplings.	Prunes.
Coffee.	Sirup.	Tea.
	Tea.	
	TUESDAY.	
Mush and milk.	Mutton-broth soup.	Round steak.
Sausage.	Leg mutton, stewed.	Boiled potatoes.
Fried potatoes.	Peas.	Fried onions.
Rice.	Boiled potatoes.	Apple fritters.
Corn cake.	Horseradish.	Rice.
Sirup.	Cold slaw.	Sirup.
Bananas.	Tapioca pudding, lemon sauce.	Tea.
Coffee.	Cold meats.	
	WEDNESDAY.	
Mush and milk.	Tomato soup.	Cold meats.
Papaya.	Rib roast.	Baked beans.
Boiled eggs (2).	Dressing.	Boiled potatoes.
Fried potatoes.	Boiled potatoes.	Rice.
Rice.	Creamed onions.	Gingerbread.
Corn bread.	Boiled sweet potatoes.	Tea.
Coffee.	Celery salad.	
Sirup.	Pie, fruit.	
	Tea.	
	THURSDAY.	
Mush and milk.	Vegetable soup.	Cold meats.
Pork chops.	Roast veal, dressing.	Potato cakes.
Fried potatoes.	Mashed potatoes.	Rice.
Rice.	Lima beans.	Stewed apples.
Soda biscuits.	Cheese salad.	Cake.
Honey.	Peach cobbler, with milk and sugar.	Tea.
Coffee.	Codfish hash.	

Bill of fare, quarantine station—Continued.

FRIDAY.

Breakfast.	Dinner.	Supper.
Mush and milk. Salt mackerel. Round steak. Boiled potatoes. Rice. Muffins. Papaya. Coffee.	Soup. Fried mullet. Corned beef. Boiled potatoes. Cabbage. Roast sweet potatoes. Cornstarch pudding, vanila sauce. Veal salad. Tea.	Hamburg steak. Tomato, Spanish sauce. Cold corned beef. Boiled potatoes. Rice. Prunes. Tea.

SATURDAY.

Mush and milk. Corned-beef hash. Fried potatoes. Rice. Corn cake and sirup. Bananas. Coffee.	Soup. Roast pork, apple sauce. Brown potatoes. Baked sweet potatoes. Turnips. Fish salad. Pumpkin pie. Cheese. Tea.	Sirloin steak. Baked potatoes. Macaroni and cheese. Rice. Doughnuts. Tea.

Requisitions.

SUNDAY, AUGUST 5, 1906.

Chicken	pounds..	16
Rump roast	do....	4
Mutton chops	do....	8
Tomatoes	do....	5
Green corn	do....	3
Celery	do....	1
Milk	quarts..	7
Ice	pounds..	50
Bread	do....	12
Potatoes	do....	20

Miscellaneous groceries, etc.: Ham, eggs, coffee, sugar, butter, fruit, poi, etc.

MONDAY, AUGUST 6, 1906.

Rump roast	pounds..	8
Sirloin steak	do....	8
Sweet potatoes	do.. .	25
Cabbage	do....	8
Beets	do....	6
Fruit	do....	9
Onions	do....	8
Milk	quarts..	7
Ice	pounds..	50
Bread	do....	12
Potatoes	do....	20

Miscellaneous groceries, etc.: Flour, rice, coffee, sugar, fruit, honey, cheese, etc.

TUESDAY, AUGUST 7, 1906.

Rib roast	pounds..	8
Rump roast	do....	7
Loin pork	do ...	10
Fruit	do ...	15
Lettuce	do....	3
Tomatoes	do....	2

TUESDAY, AUGUST 7, 1906—Continued.

Lemons	dozen..	1
Milk	quarts..	7
Ice	pounds..	50
Bread	do....	12
Potatoes	do....	20

Miscellaneous groceries, etc.: Flour, rice, corn meal, sirup, fruit, coffee, tapioca, etc.

WEDNESDAY, AUGUST 8, 1906.

Leg mutton	pounds..	10
Rump roast	do....	6
Bacon	do....	3
Milk	quarts..	7
Ice	pounds..	50
Bread	do....	12
Potatoes	do....	20

Miscellaneous groceries, etc.: Flour, oatmeal, fruit, coffee, sirup, rice, sugar, etc.

THURSDAY, AUGUST 9, 1906.

Leg veal	pounds..	8
Rump roast	do....	5
Codfish, boneless	do....	4
Salt pork	do....	5
Salt mackerel	do....	2
Fruit	do....	15
Onions	do....	8
String beans	do....	2
Milk	quarts..	7
Ice	pounds..	50
Bread	do....	12
Potatoes	do....	20

Miscellaneous groceries, etc.: Honey, sugar, coffee, flour, rice, fruit, etc.

FRIDAY, AUGUST 10, 1906.		
Corned beef	pounds	8
Mullet	do	8
Rump roast	do	7
Sirloin steak	do	4
Lettuce	do	3
Sweet potatoes	do	25
Cabbage	do	8
Milk	quarts	7
Ice	pounds	50
Bread	do	12
Potatoes	do	20

Miscellaneous groceries, etc.: Sugar, fruit, coffee, rice, butter, oatmeal, etc.

SATURDAY, AUGUST 11, 1906.		
Loin pork	pounds	6
Sirloin steak	do	6
Round steak	do	4
Rump roast	do	6
Halibut	do	3
Lettuce	do	3
Fruit	pounds	10
Pumpkin	do	6
Milk	quarts	7
Ice	pounds	50
Bread	do	12
Potatoes	do	20

Miscellaneous groceries, etc.: Oatmeal, sirup, rice, cheese, sugar, coffee, fruit, etc.

SUNDAY, AUGUST 12, 1906.		
Turkey	pounds	16½
Rump roast	do	4
Corn	do	12
Lettuce	do	3
Loin pork	do	8
Milk	quarts	7
Ice	pounds	50
Bread	do	12
Potatoes	do	20

Miscellaneous groceries, etc.: Eggs, ham, fruit, butter, flour, sugar, sirup, etc.

It is almost impossible to really please a lot of first-cabin passengers, for whom a quarantine station and its associations hold nothing but horror and with whom time necessarily drags, but if there is one expedient to which the quarantine officer can resort which tends to quiet discontent more than any other it is the universal serving of hot *bouillon* and biscuit at 10.30 a. m. and tea and toast at 4.30 p. m. in addition to the regular meals. Such seemingly absurd expedients are mentioned that they may be considered as advice and their value and importance verified by actual trial.

Passengers of the second class and steerage, members of the crew, and United States sailors and soldiers are subsisted by the regular diet schedule of the Public Health and Marine-Hospital Service.

DIET TABLES.

Ordinary Diet.

BREAKFAST.

Monday.		
Coffee	pint	1
Bread	ounces	6
Butter	ounce	½
Meat hash, with vegetables	ounces	6
Stewed fruit[a]	do	3

Tuesday.		
Coffee	pint	1
Bread	ounces	6
Butter	ounce	½
Corned-beef hash, with potatoes	ounces	6

Wednesday.		
Coffee	pint	1
Bread	ounces	4
Butter	ounce	½
Fish hash, with vegetables	ounces	6

BREAKFAST—Continued.

Thursday.		
Coffee	pint	1
Bread	ounces	6
Butter	ounce	½
Meat stew	ounces	6

Friday.		
Coffee	pint	1
Bread	ounces	6
Butter	ounce	½
Fish hash, with vegetables	ounces	6

Saturday.		
Coffee	pint	1
Bread	ounces	6
Butter	ounce	½
Mutton chops	ounces	6
Fried potatoes	do	3

[a] Fresh fruit may be substituted in season.

DIET TABLES—Continued.

Ordinary Diet—Continued.

BREAKFAST—Continued.

Sunday.

Chocolate	pint	1
Bread	ounces	6
Butter	ounce	½
Meat stew	ounces	4
Fruit sauce	do	3

DINNER.

Monday.

Vegetable soup	pint	1
Beef, boiled	ounces	6
Potatoes	do	8
Pudding, with sauce	do	4
Bread	do	4

Tuesday.

Beef soup	pint	1
Beef, boiled	ounces	6
Fish, fresh	do	6
Vegetables	do	8
Bread	do	4
Fruit	do	4

Wednesday.

Mutton broth	pint	1
Mutton, boiled	ounces	6
Potatoes	do	8
Rice pudding, with sauce	do	4
Bread	do	4

Thursday.

Soup, bouillon	pint	1
Beef, roast	ounces	6
Potatoes	do	8
Bread	do	4
Fruit	do	4

Friday.

Vegetable soup	pint	1
Meat stew	ounces	8
Fish	do	6
Bread	do	4
Vegetables	do	8
Fruit	do	4

Saturday.

Barley soup	pint	1
Mutton, boiled	ounces	8
Bread	do	4
Vegetables	do	10

DINNER—Continued.

Sunday.

Soup	pint	1
Beef, roast	ounces	6
Potatoes	do	8
Other vegetables	do	4
Rice or tapioca pudding	do	4

SUPPER.

Monday.

Tea	pint	1
Bread	ounces	6
Butter	ounce	½
Fruit sauce	ounces	3

Tuesday.

Tea	pint	1
Bread	ounces	6
Butter	ounce	½
Fruit, stewed [a]	ounces	4

Wednesday.

Tea	pint	1
Bread	ounces	6
Butter	ounce	½
Cooked fruit	ounces	4

Thursday.

Tea	pint	1
Bread	ounces	4
Butter	ounce	½
Fruit pudding	ounces	4

Friday.

Tea	pint	1
Bread	ounces	4
Butter	ounce	½
Cold meat	ounces	4

Saturday.

Tea	pint	1
Bread	ounces	4
Butter	ounce	½
Rice, with sauce or sirup	ounces	4

Sunday.

Tea	pint	1
Bread	ounces	6
Butter	ounce	½
Mush and milk	ounces	12

[a] Fruit may be substituted in season.

NOTE.—The tea and coffee prepared with milk and sugar.
The quantities of the articles of diet indicate them as they are prepared ready to serve.
The above table gives the four classes of solid constituents in substantially the following proportions: Nitrogenous or plastic material, about 140 grams; fat, about 62 grams; carbohydrates (starch, sugar, etc.), about 450 grams; and salines, about 26 grams, and with about 2,250 grams of water. Although these quantities are somewhat in excess of the estimates for "healthy adults at rest," they are none too great for convalescents in whom tissue metamorphosis is being carried on, not only in the interest of repair or present waste from use, but in the interest of repair of past waste from disease, a point which should not be overlooked in the construction of hospital dietaries. In making any change from the above, the substituted articles should be in such quantities and of such kinds as to furnish constituents equivalent to those of the articles replaced.

Oriental cooly immigrants as a class are frequently placed in quarantine in large numbers, and the problem of their subsistence is fortunately easily solved. Boiled rice and meat stew are their staple diet, and the daily subsistence requisition should be made on a basis of 1 bag of rice and 50 pounds of meat for 100 coolies.

QUARANTINE STATION MANAGEMENT.

A large modern quarantine station presents, as public institutions go, some very unique features. Being essentially an emergency institution, it is subject to alternate periods of idleness and activity. For weeks or even months the duties of the personnel of a quarantine station may be limited to the care and preservation of the buildings, machinery, and other equipment. Without warning these duties may be suddenly increased to include the care and treatment of a large passenger steamer infected with quarantinable disease. At such times the preparedness of a station is given a most severe test, and the organization of the station, suddenly changed or adapted to the new conditions, frequently does not appear to the greatest advantage.

A modern hotel or steamship, each entailing the housing and maintenance of many classes of people and the care of much machinery, is usually in constant activity, practically to the limit of its usefulness, so that once perfect organization is acquired, the routine practice or drilling of the employees, together with the constant use of the machinery serve automatically to maintain the said organization at a regular and normal standard. Should the hotel suddenly lose all of its guests, or the steamship be taken out of commission, the resumption of full activity would be necessarily attended by some confusion and the display of a certain lack of organization, even though the mechanical departments were in the meanwhile maintained in perfect working condition. That the maintenance even of the mechanical departments of either a hotel or a steamship on a working basis during a period of nonuse is a difficult matter, probably all hotel and steamship men will agree. The nonuse of machinery not only causes a deterioration in the machinery itself, but causes the employees operating the latter to soon forget their good "team work," which is so vitally necessary not only to the proper operation of any kind of machinery, but to the proper performance of any function. If a modern quarantine station could have infected vessels constantly arriving for treatment, the conditions of organization and preparedness would be ideal. The actual problem which confronts a quarantine officer is the maintenance of an institution during long or short periods of practical nonuse at such a state of efficiency and preparedness that he can on two hours' notice handle a passenger steamer, perhaps a large one, infected with quarantinable disease.

With such a problem confronting him, it may be said that the medical officer in command of a modern quarantine station must not only possess good professional qualifications, but executive ability, common sense, mechanical ingenuity, and tact as well.

Contributory to successful quarantine station management, the medical officer in command should have assistants with good pro-

fessional qualifications and men or attendants who are loyal, intelligent, and sober. A medical officer in command with good executive ability, quickly learning the qualifications and actual worth of his own men, and instinctively noticing the qualifications of "other people's" men as they are likely to apply to his own particular needs, applies the law, "the office seeks the man" and by degree replaces any inefficient men amongst his own complement with suitable men from "at large."

The duties to be performed on a quarantine station.—The duties to be performed on a quarantine station may be divided into those which should be performed daily, and those which should be performed when the station is in active quarantine work.

Daily duties.—The daily duties may be divided into—

First. The care, preservation, and repair of the boarding steamer.

Second. The care, preservation, and repair of the small boats.

Third. The care, preservation, and repair of disinfecting vessels.

Fourth. The care, preservation, and repair of the wharves.

Fifth. The care, preservation, and repair of buildings.

Sixth. The care, preservation, and repair of machinery.

Seventh. Miscellaneous duties.

The care, preservation, and repair of the boarding steamer.—The proper care, preservation, and repair of a boarding steamer depends almost entirely upon the efficiency of the pilot and engineer, and their ability to recommend for employment deck hands and firemen of equal relative efficiency. A sober, steady, towboat captain who keeps his vessel in a shipshape condition, and who runs her steadily and without avoidable mishap, will usually prove a suitable pilot for a quarantine boarding steamer.

The hours and general duty of a towboat are not unlike those of a boarding steamer, and it will usually be found that a towboat captain possesses the requisite amount of tact in maintaining dignified and amicable relations with the engineer and his forces.

The pilot should be held responsible for the care of the ship, exclusive of the machinery, the navigation of the ship, and the discipline on board. The engineer should be a man of steady and sober habits and should have an ocean-going marine license at least as "first assistant, ocean steamship," and also certified machine-shop service. He should not only be capable of making minor repairs to marine engines and boilers, but he should have some knowledge of electricity and electrical machinery. The engineer should also be able to make out specifications and estimates of necessary repairs and the materials required therefor.

The entire care and responsibility of the machinery should be vested in the engineer, and in matters relating directly to the condition of the machinery he should report directly to the medical

officer in command. Otherwise the engineer reports to the pilot and receives orders from him. The details governing the care and preservation of quarantine steamers are clearly set forth in the "Regulations for the care of quarantine steamers," published by the U. S. Public Health and Marine-Hospital Service.

The care, preservation, and repair of small boats.—The care of small boats at a quarantine station is very important. Unless small boats receive constant attention and repair they always look untidy and soon wear out. The tendency is strong on the part of the average boatman to paint rather than clean a boat. The result is a "caking" of paint on the sides with a resulting early decay of the planking. A rowboat should be cleaned daily and the condition of the planking, thwarts, rowlock, sockets, and oars noted.

The care, preservation, and repair of disinfecting vessels.—The care, preservation, and repair of disinfecting vessels may be considered under two heads, one being the care of the disinfecting machinery on board, and the other the care of the hull proper. The care of the disinfecting machinery on a disinfecting vessel is, for practical purposes, set forth further on in the section devoted to the care of disinfecting machinery in general.

The hull of a disinfecting vessel, on account of the wear and tear incident to its being frequently moved to and from vessels or wharves, requires constant watching and repair. The copper sheathing is frequently torn in places or becomes detached, the chain ports become loose from rust, the bits may become loose from the same cause, the bilge pump exhaust pipes may become clogged, allowing water to remain in the hold, which soon becomes foul and boggy. The calking of the hull planking may become defective. The deck is subject to great wear and tear from the handling of trunks and sulphur, and the superstructure is frequently damaged by the projecting spars of vessels. Disinfecting vessels on account of the heat of the boilers, sulphur furnaces, and disinfecting chambers usually suffer from warping of the timbers of the superstructure, and are on the whole constantly in need of retouching with paint, not only on account of the heat generated within, but on account of the elements without.

The care, preservation, and repair of wharves.—The care, preservation, and repair of wharves includes the care of dolphins, mooring piles, straight and bracing piles, iron work, and floor timbers.

Dolphins should be watched carefully to detect for immediate repair any damage to the copper sheathing. Mooring piles are apt to wear and splinter at their points of protrusion through the floor of the wharf. This may be prevented by chocking and cleating. Straight and bracing piles, on account of the leakage of water from the wharf proper, soon become at first boggy and then rotten at their upper ends. This may be prevented by carefully calking the planking

just above the piles, and by the frequent application to the piles near the cap of boiling tar. Iron work used in the construction of a wharf, either in the form of girders, braces, or bolts, undergoes a constant rusting process. Such iron work should be inspected carefully once a month, and all rusting areas chipped with a chipping hammer, covered over with red lead, and then given a coat of ordinary lamp-black and oil. The floor timbers of a wharf should be given especial attention. The dragging of heavy objects, such as trunks and chests, should be forbidden, and the tendency to splintering should be counteracted by the application of boiling tar.

The care, preservation, and repair of buildings.—Quarantine station buildings as a rule deteriorate rapidly from two distinct causes. First, their lack of steady occupancy and use, which usually ensures to buildings the normal amount of care where decent people are concerned. Second, the fact that when said buildings are occupied the occupants are apt to be a class of people who, whether through a natural resentment at being held under surveillance, or through sheer ignorance, have little or no regard for law and order. For instance, it is not uncommon during the daily inspection of the quarters occupied by people of the immigrant class, or even of classes from whom much more might reasonably be expected, to find windows broken, doors sprung, locks broken, plumbing destroyed and stolen, and walls defaced by the carving or writing of names or obscene rhymes, etc

The wire window, door, and ventilator screens, which must be necessarily kept intact if quarantine station buildings are to be maintained in a vermin-proof condition, frequently need repairing.

Quarantine station buildings, because they are usually located near the water, where they are frequently exposed to salt water spray or mist, require frequent painting.

The care, preservation, and repair of machinery.—The machinery of a quarantine station usually consists of steam disinfecting chambers, sulphur furnaces, fans, and engines, water and bichloride pumps, hoisting engines, and autoclaves. In addition there are boilers, fire extinguishers, and a steam laundry plant.

Steam disinfecting chambers.—The steam chambers should be frequently inspected for rust both on their outer and inner surfaces. All rust spots should be rubbed down to the metal with fine emery cloth, then painted with red lead. The greater part of the outer surface, which is usually covered with asbestos, should be kept perfectly white and clean. In tightening the iron doors at either end, care should be observed in not unduly compressing the rubber gaskets, and the latter should be kept covered with graphite. All steam-pipe connections should be kept perfectly tight. After using the formaldehyde attachments, steam should be run through the pipes and cylinders. Care should be taken to let out the water, which results from

the condensation of the steam, in the jacket of the chamber after using the latter.

The sulphur furnaces.—Owing to the excessive and variable temperatures to which the sulphur furnaces are subjected, the latter are apt to be constantly more or less rusty. The outer and inner surfaces should be frequently scraped, wiped off with mops soaked in kerosene oil, and then painted with lampblack and oil. The sulphur pipes should be so arranged that the elbows are easily detachable for scraping and painting.

Flexible sulphur hose should be suspended in wide canvas slings, otherwise it is liable to bend and crack.

The sulphur fans and engines.—The sulphur fans should be scraped and cleaned at least once a month. The sulphur engines require little attention and repair save sufficient lubrication.

Water and bichloride pumps.—After using the bichloride pump it should be washed out thoroughly with fresh water. The condition of the steam and water cylinder packing should be given regular attention, and renewed if necessary. The piston rods and valve shafts should be kept bright and well oiled.

Hoisting engines.—These usually give very little trouble and usually require only enough care to prevent the accumulation of rust.

Autoclaves.—Autoclaves require constant and careful attention. The Primus lamp pump should be kept well packed, and fine wire should be always kept in the holes in the burner jet. The valves of the autoclave proper should be kept in order and the casing painted occasionally with graphite paint.

Boilers.—Boilers, if covered with asbestos, should be painted white or yellow; if left unprotected they should be kept free from rust and painted with lamp black and oil. Boilers should be washed out frequently and "blown out" after using.

Fire extinguishers.—Fire extinguishers should be discharged at least once a month at fire drill and then recharged. The rubber gaskets in the crown and the washers in the spigots are apt to harden unless they are carefully watched.

The steam laundry plant.—A steam laundry plant requires much attention if it is to be kept free from rust. The moving surfaces, pulleys, and pulley shafts should always be kept bright, and lubrication should be maintained.

Miscellaneous duties.—The station day begins at 6 a. m., and ends at 5 p. m. The station night begins at 5 p. m. and ends at 6 a. m. The day hours may be as follows: 6 a. m., turn out all hands; 6.30 a. m., breakfast; 7 a. m., muster, at which general and special orders for the day are read, and assignments for duty made; thirty minutes are given for putting quarters in order; 7.30 a. m., work begins; 11 a. m., quick inspection; 11.45 a. m., work ceases—preparations are

made for dinner; 12 m., dinner; 12.45 p. m., work resumed; 4.45 p. m., work for the day ceases; 5 p. m., supper; 6 p. m., night watch reports for duty and orders. The raising and lowering of the station flag should be assigned as special duty. At 11 o'clock the quick inspection is made to determine the exact status of the station from a standpoint of discipline, cleanliness, and repair. When the quarantine station is in active operation with quarantinable disease on hand and people in detention, the station day proceeds as usual, only a larger or smaller number of attendants are given such special duty in such special hours as the conditions warrant, and a temporary or sub-organization is devised to fulfill the requirements.

OUT-GOING QUARANTINE.

Through the process of "out-going" quarantine a quarantine officer may protect other ports from quarantinable disease which is present in the port where he is stationed or in the territory contiguous thereto. This work consists of the certification of passengers, baggage, and freight, the disinfection of vessels, the inspection of vessels as to their conduct after disinfecting, the proper mooring of vessels not requiring disinfection, and the disinfection of wharves.

Passengers and crews are required to report at the quarantine office and furnish satisfactory evidence as to their place of residence, and according to their status, are either given a permit to embark without disinfection of baggage, or are first required to deliver their baggage for disinfection, the permit being given after the quarantine examination is made. The names, with places of residences, are made into duplicate lists for a final inspection immediately before the sailing of the vessel, and the lists containing all information sealed and forwarded as part of the ship's papers. After its disinfection all baggage is held until just before the sailing hour and is then delivered aboard the steamer. Yellow labels, marked "disinfected," are placed on each piece of baggage disinfected. The hull of a vessel must either be disinfected or properly guarded against the necessity therefor. In other words neither passengers nor baggage are certified as safe if they are to be transported in a suspected or infected hull. All freight orders must be examined, the safe articles viséed and those considered dangerous either disinfected or rejected.

The disinfection of baggage and vessels is carried out according to the United States quarantine regulations.

FIG 14.—A BIRD'S-EYE VIEW OF A SMALL NATIONAL QUARANTINE STATION.

MARITIME QUARANTINE EQUIPMENT.

MARITIME QUARANTINE EQUIPMENT

Shore Quarantine Institutions.

Shore quarantine institutions are divisible into, first, inspection stations; second, shore quarantine stations.

INSPECTION STATIONS.

Inspection stations are maintained at certain designated points where vessels are subject simply to inspection to determine their sanitary status, being given free pratique if entitled thereto, or remanded to the nearest shore quarantine station for treatment if found either infected with or suspected of being infected with quarantinable disease. The ports at which the quarantine equipment is limited simply to inspection facilities are either those not far distant from a complete quarantine station or those wherein the commerce is too small to justify the maintenance of a complete quarantine station. For example, the ports of San Francisco and San Diego in California are equipped with complete quarantine stations, while the ports of Monterey, Santa Barbara, Los Angeles, San Pedro, and Newport, all of which are located on the Pacific coast between San Francisco and San Diego, are provided simply with inspection facilities. In the event it is necessary to remand a vessel to a quarantine station for treatment, either San Francisco or San Diego may be used as a port of refuge, a choice of ports being determined by the distance to be traveled.

SHORE QUARANTINE STATIONS.

The selection of a site for a shore quarantine station.—The site on which a quarantine station is to be built should be well adapted for the peculiar purposes for which it is to be used. Indeed the practical value and public utility of a quarantine station depends largely upon the degree to which the site approaches ideal conditions. An ideal site combines natural isolation, convenience to recognized harbor channels, and close proximity to a protected deep-water anchorage. By the term natural isolation is meant the barriers formed by the topography of a place, such as precipices, ravines, and streams. For example, a tongue-shaped peninsula jutting from the base of a

high hill or precipice into deep water would constitute a practical and ideal mainland quarantine station site with natural isolation. A small island, located within harbor confines and not far removed from the mainland, is frequently available for quarantine station purposes, and can usually be made suitable. Such a site exemplifies clearly the term, and fulfills the conditions, of natural isolation. Convenience to recognized harbor channels is an important consideration in the selection of a site for a quarantine station, because in requiring vessels to proceed to a quarantine station located a great distance away from the inspecting anchorage considerable hardship may be imposed upon sailing vessels on account of necessarily large towage bills and upon steamers on account of the loss of valuable time.

The third condition, that of close proximity to protected deep-water anchorage is very important, both on account of the necessity of sufficient depth of water and of protection from heavy winds and waves. The minimum depth of water required for the largest ocean carriers is 34 feet, therefore an anchorage with less depth will not be a safe one for a deep-draft vessel. Protection from heavy winds and waves is absolutely essential in an anchorage at a quarantine station. Frequently sailing vessels bring ballast which, if consisting of either loam, sweepings, or mud, it may be necessary to discharge in quarantine. Unless the vessel be anchored in a place protected from heavy winds, she will be in danger of capsizing after the removal of ballast or even during the process of removal. It is true ballast logs may be fastened on either side of a vessel to prevent mishap under such circumstances, yet their absolute safety is extremely doubtful. Protection from excessive wave motion is just as essential as that from exposure to the wind, as the former will prove an obstacle to the safe handling of vessels while they are being placed alongside the quarantine station wharf, as well as a source of danger to the wharf itself. Even small boats are subjected to great wear and tear by excessive wave motion.

The last two conditions, convenience to recognized harbor channels and close proximity to protected deep-water anchorage, if lacking, may be overcome by structural devices or executive measures, but the condition of natural isolation, if lacking, is almost certain to bring the public safety and therefore the integrity of quarantine as a principle into jeopardy. To effect the requisite isolation at a quarantine station where it is not already provided by nature, recourse must be had to some form of personal restriction, which measure is unreliable and to say the least is undesirable. The area of a quarantine reservation should comprise at the least 5 or preferably 30 acres of land. A gentle slope on a rocky subsoil is very desirable, and a good water supply a positive necessity. The num-

FIG. 15.—A QUARANTINE STATION HOSPITAL WITH ISOLATION BUILDINGS

FIG. 16.—A QUARANTINE STATION HOSPITAL WARD.

FIG 17.—A QUARANTINE STATION LABORATORY

included in one building. The quarters for commissioned and non-commissioned officers should be constructed with a view to local needs and conditions. Above all things they should be comfortably but inexpensively arranged and appointed.

The attendants' barracks should consist of a single building varying in size with the number of attendants to be accommodated. The rooms should open into a very wide central hall. This hall may be used by the attendants as a lounging place or club, or as an improvised gymnasium. Too much care can not be observed in providing attendants with suitable quarters, as life on a quarantine station is frequently tiresome and uneventful, and it is necessary to maintain as much esprit du corps as possible by an arrangement of quarters tending to sociability and good fellowship.

The disinfecting department.—This department includes the disinfecting warehouse and its contained disinfecting machinery and appliances. The disinfecting warehouse is always located upon the quarantine station wharf if the station is provided with a wharf. Where the station landing facilities are limited to a small platform or boathouse, the disinfecting warehouse is located at a suitable place on the quarantine station reservation. A disinfecting warehouse must be equipped to perform two quarantine functions. One of these functions is the disinfection of vessels, another the disinfection of personal and miscellaneous effects. For the performance of these functions the machinery and general equipment should be so arranged in the warehouse that almost perfect unison in operation is attained.

For the disinfection of a vessel sulphur furnaces, sulphur pots, large and small, formaldehyde autoclaves, and carbolic acid and bichloride of mercury solutions are provided. The sulphur furnaces, preferably two or four in number, are arranged about the center of the wharf on a trestle 10 feet high. On the same trestle but at a still higher elevation should be placed two 2,000-gallon tanks, one for carbolic acid solution and the other for bichloride of mercury. A number of iron pots and galvanized iron tubs, some large for the disinfection of big compartments, and many small ones for the disinfection of staterooms, should be kept ready for use near by. On the trestle to the rear of the sulphur furnaces a sufficient supply of sulphur is kept ready for use. For the disinfection of personal effects, steam disinfecting chambers, with formaldehyd generators attached, should be located in the center of the warehouse. These chambers are made to project on either side of a central partition which divides the "infected" room from the "disinfected" room. A checking room for the safe-keeping of valuables should be maintained in the disinfecting warehouse.

FIG. 16.—A QUARANTINE STATION HOSPITAL WARD.

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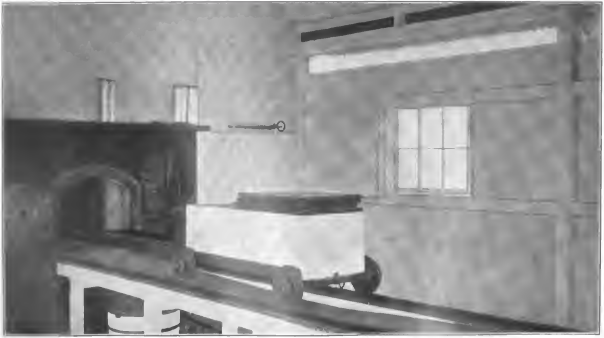


FIG 18.—THE INTERIOR OF A QUARANTINE STATION COMPOSITE NECROPSY ROOM AND CREMATORY.

The mechanical department.—This includes the steam laundry and the artificers' workrooms. Every large quarantine station should be provided with a suitable steam-laundry plant. The machinery should be selected with some reference to the prevailing climate of the port wherein the quarantine station is located. For instance, drying chambers are useless in the Tropics where there is usually an abundance of sunshine, but absolutely necessary in a climate where foggy weather prevails.

The artificers' workrooms comprise the carpenter shop, paint shop, machine and plumber shop. This division is all important to a quarantine station, because emergency repairs are constantly necessary, and the good general preservation of buildings and equipment can not be maintained without a well-conducted artificer shop.

The pathological department.—The pathological department comprises the quarantine hospitals, the bacteriological laboratory, and a composite autopsy room and crematory. This department as a whole should be located as far as possible from the other departments and at the same time to the leeward of them.

The quarantine hospital should be divided into two bed wards or units, wherein the sick may be separated according to their class, sex, and disease. One or more of these units or small wards may be used at any time for purely isolation purposes. It is more desirable, although more expensive, to separate the units by open passages or even to construct them as small detached cottages. Practical experience will show the large wards to be ill adapted for the treatment of persons suffering from quarantinable disease, and such wards will ultimately become obsolete. These cottages or units should be eight in number for an average quarantine station, and should have as accessories a small bath house, a small kitchen, and a cottage for two orderlies. They may be constructed of lumber, but in their construction the following points are essential:

First. The cottages should be raised on an average at least 2½ feet from the ground.

Second. The studding should be built on the outside of the siding, the inside lining being closely approximated to the latter. This makes a double-wall cottage without dark spaces, or in other words, a vermin-proof building, between the walls of which there are no spaces capable of accommodating even the smallest of vermin.

Third. The windows should contain only one sash and be made to swing on hinges to the inside.

Fourth. The windows should be protected by fine-mesh bronze or brass mosquito wire screening on the outside, and each door should be provided with an insect vestibule.

Fifth. Portable or roller bath tubs and enameled pail commodes should be provided in order that the disinfection of bath water and excreta may be effected.

Sixth. Each window and door should be provided with rubber stripping or weather strips which serve the two purposes of making rooms practically air-tight and vermin proof and therefore easy of disinfection.

Seventh. All hardware should be of brass or composition bronze.

The morgue and crematory.—These very necessary adjuncts to a properly appointed quarantine station had best be built so that the crematory will be closely connected with and convenient to the morgue. The crematory may be a very simple and inexpensive reverberatory hearth. The hearth should be about 3 feet wide and 7 feet long. The vault should be arched, the arch commencing at its junction with the side of the hearth to reach a height of 2½ feet. The fire box is located at one end of the hearth and from the other end the vertical flame shaft leads to the chimney. The opening of the furnace is provided with an ordinary cast-iron door, through which the body is rolled on a car especially constructed for the purpose. This car runs on tracks mounted on a light trestle which stands 3 feet from the floor and which also serves as an autopsy table prior to the rolling of the body along the trestle into the crematory furnace.

The autopsy room and the crematory proper should be separated by a partition. The materials used in the construction of the crematory and autopsy building should be corrugated-iron roofing and sides, on a frame of 2-inch iron piping. The furnace should be constructed of vitrified brick and the whole encircled with iron bands. The hearth and fire passages should be lined with regular fire brick.

The chimney should be built of brick, should have a height of at least 30 feet, and should be provided with a damper. Wood is a very good fuel for the simple hearth just described, and, although it is somewhat more expensive to use, is economical in the long run, as it does not burn out the hearth, vault, and chimney to the extent that coal does.

The bacteriological laboratory should be small and compact and appointed simply for diagnostic purposes. A small animal barn is a necessary adjunct to any quarantine station. Guinea pigs, rabbits, and rats should always be kept on hand.

The first-cabin passenger department.—The detention quarters for first-cabin passengers must furnish a degree of comfort at least comparable with that which commonly falls to the lot of passengers of this class when afloat.

The easiest way in which to house cabin passengers is by the construction of buildings containing twelve small rooms arranged on either side of a central general partition. The rooms should measure 10 by 15 feet at the sides, with ceilings not more than 10 feet from the floor. Such rooms should accommodate two persons. On either side of the building a large wide porch should be provided. A build-

FIG. 19. A FIRST CABIN PASSENGER DETENTION BUILDING.

FIG. 20.—BUILDING FOR DETENTION OF SECOND-CABIN PASSENGERS.

FIG 21 TYPE OF BUILDING USED FOR THE DETENTION OF ORIENTAL STEERAGE PASSENGERS AND CREWS

ing such as the one described will accommodate from forty-eight to sixty persons. One or more of such buildings may be provided, as necessity demands. It may be said on general principles that for the average port there should be quarantine detention facilities for at least one hundred first-class passengers. There should be a four-bed or four-room hospital for the accommodation of persons in the first cabin suffering from nonquarantinable disease. The kitchen and dining rooms should be in separate buildings in order that the hazard from fire may be decreased and administration made easier.

The second-cabin department.—The quarters for second-cabin passengers should consist of one-story cottages or units containing six rooms on either side of a central partition. Large porches should be provided as in the case of the quarters above described for first-cabin passengers. The rooms may be 15 feet square, and the building as a whole should accommodate forty-eight persons. The number of such units or buildings required on the average quarantine station will be about four. The rooms should be equipped with folding iron enamel bunks. The bath houses, water-closets, and kitchen should be separate.

The steerage department.—This department is a very important one on all quarantine stations. It is probable that nine-tenths of the quarantinable diseases occur either in the steerage passengers or in the crew of a vessel. At certain quarantine stations the problem of caring for or detaining steerage passengers is an exceedingly simple one. At those ports in direct communication with the Orient the steerage passengers as a class are apt to be composed of persons of many different nationalities. Therefore the steerage detention department of such quarantine stations must be built and conducted as far as possible in accordance with these peculiar conditions. The most practical steerage detention department consists of a long building, which with its auxiliary structures is built around a hollow square. All spaces between buildings are closed by means of high picket fences and ingress or egress is confined to one large central gate. The long building is divided into quarters for various nationalities and further subdivided for the sexes. The bath houses and latrine sheds should be distinctly separate. The kitchen should occupy a central position in the hollow square in order that the distribution of food may take place from all four sides of the building. In the compartments used by the Orientals the sleeping accommodations should consist of low raised platforms on which mats may be spread. The Oriental prefers sleeping on such a platform to the use of an ordinary bed. The platforms should be made of surfaced material and should be kept well painted. For Orientals large bath tubs are necessary. These may be constructed of wood and let into

the ground, or built on the floor of the house in the regular manner. A limited number of showers may also be provided, as these are coming into use by the Orientals. A constant supply of hot water is an absolute necessity in the steerage department. The latrines should consist of long zinc-lined troughs constructed so as to admit of the disinfection of the excreta before it is discharged into the sewer mains. Every device which ingenuity suggests should be employed to protect steerage passengers, particularly Orientals, from mosquitoes and vermin. While no one general plan or system of construction will accomplish the result, a combination of screening on the vestibule plan with the help of pyrethrum powder will solve this problem as a general rule.

Military department.—A department for the handling of large bodies of troops is necessary in those ports which are along the routes usually traversed by military transports It is not an unusual thing for a transport to carry 1,500 troops, therefore it is reasonable that some accommodations be provided at certain quarantine stations for at least that number. A quarantine military camp need only be maintained in skeleton form. It should consist of wooden tent floors arranged in company streets, with the latrines well off to the leeward and the cook houses located well to the windward. There should be sufficient water supply, and this should be piped to a point convenient to the tent floors. The tent floors should measure 14 by 15 feet in order to accommodate an ordinary military hospital tent. For quarantine purposes such a tent will hold eight soldiers. Canvas cots should be issued, as these are easily stowed away and kept clean. The cook houses should always be ready for the reception of the portable cook ovens, or else regular ranges should be built into the cook houses. The latrine houses should be equipped with long zinc-lined troughs wherein excreta is disinfected prior to discharge into the sewer mains.

GENERAL SUGGESTIONS GOVERNING THE CONSTRUCTION OF QUARANTINE-STATION BUILDINGS.

Two of the most important quarantinable diseases, yellow fever and plague, are disseminated through intermediate hosts. The intermediate host of yellow fever is the Stegomyia calopus mosquito, an insect abounding in most tropical or semitropical countries. The intermediate hosts of plague being vermin, especially rats and their fleas, it is essential, therefore, that every endeavor should be made to prevent mosquitoes and vermin from effecting an entrance to quarantine-station buildings. It is equally essential that the propagation of insects and vermin be made impossible by definite structural schemes and scrupulously careful policing. Invading insects or vermin, like invading armies, are most effectually combated when

the area or country invaded is rendered uninhabitable. In rendering quarantine-station buildings uninhabitable to the above-mentioned intermediate hosts it is essential that there should be no dark spaces in the houses or between their walls, and no permanently damp or wet places near the houses. In other words, vermin-proof construction must be carried out completely in buildings on quarantine stations, and the grounds of these quarantine stations must be graded so as to make permanently damp places an impossibility. In a vermin-proof house all spaces or intervals between the walls are obliterated by the close apposition of the outer and inner walls, the studding or framing being left exposed either on the outside of the building or on the inside of the rooms. The two layers of flooring, even in the case of a two-story building, being likewise placed in close apposition and laid on exposed cross beams or joists. Therefore, in a vermin-proof structure either insects or vermin are easily visible, as they may be found either on the inside or on the outside of a house, but never between anything. This vermin-proof construction is not expensive, and when interiors are finished in natural color the effect of the exposed studding and overhead rafters is pleasing, not to say attractive. In constructing the roof an interval should be left between it and the ceiling of the rooms, said interval being protected on all four sides of the building by wire-gauze screening.

All piping and wiring must be left exposed or else run through removable shafts. Every house should be built at a mean elevation of 3 feet from the ground, and the soil underneath should be tamped hard and lightly covered with whitewash or lime in order that a white surface may be provided which will reflect the light and disclose at once the presence of any object requiring removal. The construction of the side walls of the vermin-proof house only admits of the use of the single square hinged windows. These should be 3 feet square and made preferably with small diamond window panes. The window jambs should be reinforced by rubber stripping, which, acting as gaskets when the windows are closed, renders the room air-tight for proper disinfection. The door jambs should be similarly arranged with the same object in view. All doors should be protected by bronze wire-screen vestibules and all windows by wire screening immovably fastened to the window frame on the outside of the building. The plumbing should be centralized as much as possible, all pipes being grouped within a short radius. This permits the easy inspection of the plumbing to detect defects and facilitates making repairs when such are necessary. All rooms should be provided with small screen-protected openings or square ports placed near the ceiling in the side walls. Such openings or ports should be provided with hinged doors and rubber stripping in order that they may be closed and rendered air-tight when occasion requires. These

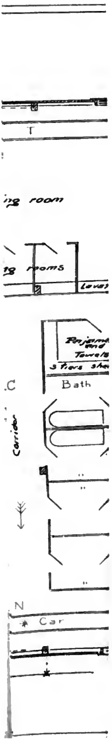
openings are both useful and efficient for ventilating purposes in tropical countries, where frequently on account of wind and weather the proper ventilation can not be maintained by open windows and doors.

Trees and shrubs should not be planted within 10 feet of any building on a quarantine station, and no trees or shrubs with large leaves capable of holding water or maintaining moisture should be allowed on the reservation. In other words, an area likely to be invaded by the intermediate hosts of the various quarantinable diseases should be rendered as nearly as possible uninhabitable for them.

DISINFECTING WHARVES.

A disinfecting wharf is arranged especially and exclusively for the fumigation of vessels and the disinfection of baggage and freight. Figure 22 shows the floor plan and general arrangement of a disinfecting wharf superstructure. In this drawing the dressing, waiting, and bath rooms, and the steam disinfecting chambers are shown. The sulphur furnaces and the bichloride and carbolic-acid tanks are mounted on trestles at a higher level over the steam disinfecting chambers.

Steerage passengers are taken from the gang plank of the vessel through the opening A, after which the men and women pass through the openings B and C into the men's and women's undressing rooms D and E. The disinfecting cars are standing in readiness at the points F and G to receive the clothing after it has been placed in wire cages and checked. After the clothing is loaded onto the cars, the latter are rolled to the right to the point P, thence to the left on the conveyor, thence through the disinfecting chambers, thence to the left along the "clean" conveyor to the point S, thence to the left to the points H and I in the waiting rooms J and K. The clothing is then unloaded and returned to the passengers, who, having had their baths, are waiting for their clothing in the waiting rooms J and K. While the clothing is going through the process above described the passengers, having disrobed, enter the shower-bath alleys at the points L and M, and, after walking through the continuous water jets emerge at the points N and O, proceed to the kimono and towel rooms Q and T. After drying and clothing themselves with the kimonos, they enter the waiting rooms J and K and exchange their checks for their baggage, which is waiting on the disinfecting cars at the points H and I. Attention is called to the arrangement by which the "clean" and "unclean" divisions of the steam chamber department are separated by the bulkhead Q and R through which the "clean" ends of the steam chambers project. On the right, overhead, one of a series of three bichloride and carbolic tanks may be seen. The sulphur furnaces are located in the positions marked X and X′.



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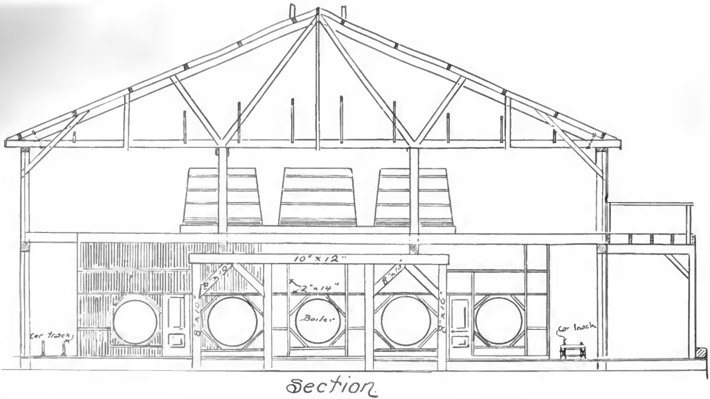

FIG 23.—CROSS-SECTION THROUGH A QUARANTINE WHARF SUPERSTRUCTURE.

FIG. 24.—A LAZARETTO SCOW.

FLOATING OR FLOTILLA QUARANTINE PLANTS.

The floating quarantine plant is suggested for use in the small ports in the Tropics, where "way-port quarantine" with sea detention will at times replace the usual detention at quarantine stations at home ports. By way of illustrating "way-port quarantine" with sea detention, let us suppose that a large passenger and mail steamer should arrive at Honolulu en route to Yokohama with a case of plague on board. "Way-port quarantine" would simply consist of the removal of the sick and direct contacts and the disinfection of the vessel. The vessel would be held in quarantine while at Honolulu and no one would be allowed on shore, yet immediately upon the completion of the disinfection the vessel would be allowed to proceed to Yokohama, the ten days' time of the voyage being used as detention. Upon the arrival of the vessel at Yokohama the quarantine officer at that port would have for his consideration, in judging the sanitary status of the vessel, the facts of previous removal of sick and disinfection of persons and things at Honolulu, together with ten days of detention at sea. Where there is likely to be much way-port quarantine work, a small floating quarantine plant is both effective and convenient, but it is in the long run expensive so far as administration is concerned. In other words, a floating plant will almost invariably fulfill the general quarantine requirements of isolation and convenience to commerce, but it is, unfortunately, rather expensive to maintain.

In those ports where suitable sites for shore quarantine stations are not available, floating quarantine plants may be absolutely necessary. In any event before a shore quarantine site in a tropical port or a port liable to be infected with plague or yellow fever is selected, the question of the desirability of a floating quarantine plant should receive full consideration.

The advantages of the floating quarantine plant may be divided into those affecting vessels and those affecting quarantine administration. The advantages offered to vessels, especially the large ocean carriers, consist in the saving of time and trouble incidental to the taking of such vessels out of the regular channels to distant anchorages, which may not have sufficient depth of water or swinging room to insure safety either to the vessel itself or to the quarantine wharf alongside of which she must be placed. The advantages offered to quarantine procedure consist in the ease with which isolation is effected, the greater daily working capacity of a plant capable of being moved either in part or as a whole from one vessel to another, and the convenience of administration as compared with the expense of running a shore plant with the same working capacity.

A flotilla plant consists of a series of barges, scows, or hulks especially converted or adapted as the component units of a complete quarantine station. In other words, a flotilla plant consists of a disinfecting scow, a lazaretto scow, and the necessary passenger-detention barges.

The disinfecting scow should be 100 feet in length and 50 feet in width, and constructed to withstand the wear and tear which the frequent handling of a large scow always entails. The bottom should be coppered and the decks should be well seasoned, calked, and filled. The hold should be constructed so as to admit of complete ventilation and thorough cleansing. On the main deck a strong superstructure two stories high should be provided. On the cover or top deck of the superstructure the battery of sulphur furnaces, the boiler, and the disinfecting tanks should be placed. On the next deck below, the steam disinfecting chambers and the bathrooms should be located, and finally, on the lower or main deck, all of the room in the superstructure should be used as a passenger mustering or waiting room.

The disinfecting scow should also be equipped with automatic fenders, a steam winch, four good anchors, and a steam crane for hoisting baggage. The lazaretto scows should be two in number but very much smaller in size than the disinfecting scows. The length of such a scow need be only 50 feet, the breadth 40 feet. The character of construction should conform in a general way to that recommended above for the disinfecting scow. In its general appearance it should resemble a house boat, and be comfortably appointed. On the main deck there should be a superstructure consisting of two decks or stories. The top story or compartment should be devoted entirely to ward purposes. It should be equipped with special reference to the care and treatment of quarantinable diseases. The compartment below on the main deck should be subdivided into staterooms for nurses and cook, and galley and storerooms. All windows, doors, and other openings should be protected by bronze wire screening, and devices for rendering all compartments air-tight for proper disinfection should be provided.

A floating quarantine plant should never have less than two such lazaretto scows, for the reason that diseases such as plague and smallpox or cholera and smallpox if treated at the same time must necessarily be widely separated.

The detention scows should consist of two distinct units, one for the housing of second cabin and another for steerage passengers and crew. Obsolete sailing vessels or hulks may be used for detention purposes after suitable alterations are made and the proper appointments furnished. It is intended that the two classes of passengers should be given accommodations and care, while undergoing quarantine detention, of a kind similar to the accommodations accorded

FIG 25.—A DISINFECTING VESSEL SIMULTANEOUSLY DISINFECTING TWO OTHER VESSELS.

their respective classes on passenger steamers. A flotilla quarantine plant should be furnished with mooring buoys placed in protected coves where access to shore will not be difficult, and where the disinfecting scow can be got at readily for immediate use when required.

DISINFECTING VESSELS.

A vessel or barge of any description, if equipped with disinfecting machinery, and possessing the requisite floor space for disinfecting baggage, may be called a "disinfecting vessel."

Disinfecting vessels may therefore be used in lieu of disinfecting wharves not only for disinfecting other vessels, but for disinfecting baggage. Such vessels, if large and completely appointed, are far more serviceable for quarantine work, especially in busy ports, than quarantine wharves, even if the latter are better equipped, the reason for this being the fact that usually a wharf can accommodate only one vessel at the time, while the disinfecting vessel, if placed between two other vessels, can do double work in the same length of time. Again, considerable time is necessarily lost in bringing a vessel to and taking it away from a disinfecting wharf, while a disinfecting vessel can be moved from vessel to vessel, perhaps disinfecting several vessels with the minimum of time and expense. Another important and practical use to which a disinfecting vessel may be put is the performance of municipal disinfection by placing the said disinfecting vessel alongside of any wharf, where it at once becomes for practical purposes a shore disinfecting plant.

The size of the vessel or barge determines its capacity for handling baggage. The unpacking and packing of trunks, valises, and the like requires a great deal of floor space, so that the capacity of a vessel for this purpose is governed more by the latter than by the number of steam chambers which may be placed on board. On the other hand, the capacity of a disinfecting vessel for fumigating and spraying with bichloride solution may be rendered very great with the use of a comparatively small deck area.

Disinfecting vessels may also be improvised from the hulls of obsolete schooners, or even from large coal or freight transfer barges. Before purchasing a barge or scow it should be seen that the timbers below the water line are in good condition. It is also essential that the bottom of the barge or scow be coppered. A barge should have a deck space of at least 22 by 90 feet, and a scow should have a deck space of at least 30 by 50 feet. The bichloride tanks, coal bunkers, fresh-water tanks, store and lock rooms should be placed in the hold, where they are out of the way and where their contained stores may serve as ballast. The sulphur furnaces, fan, and its engine should be placed overhead on the main deck, as every available foot of space on the main deck should be conserved for the steam chambers

and for the room required to properly handle baggage. A disinfecting vessel should be divided athwartships by a tight compartment, through which one end of each steam chamber should project. This divides the spar-deck space into an "infected" or receiving division, and a "disinfected" or discharging division. The after end should be the "infected" end. The bath and undressing rooms should be placed overhead, on the same level as the sulphur furnaces, but to the leeward of them. The bath and dressing rooms are arranged so that a passenger, having entered the small dressing room, undresses, and having placed his clothes into a marked wire cage or clean gunny sack, hands them to an attendant, who in turn passes the clothes below for disinfection, while the passenger enters the bathroom. After leaving the bathroom the passenger passes to the dressing room, receives a clean kimono or dressing gown, and there waits for the return of his clothing from the disinfecting chambers below. Disinfecting vessels should be constructed to insure easy and complete cleansing, and all interiors above the spar deck should be kept well covered with white enamel paint.

APPENDIX.

[From the United States Quarantine Regulations, 1910.]

DISINFECTANTS AUTHORIZED BY THE UNITED STATES QUARANTINE REGULATIONS AND THE PROPER METHODS OF GENERATING AND USING SAME.

PHYSICAL DISINFECTANTS.

151. Burning. Of unquestioned efficiency, but seldom required.

152. Boiling. Very efficient and of wide range of applicability. The articles must be wholly immersed for not less than ten minutes in water actually boiling (100° C.). The addition of 1 per cent of carbonate of soda renders the process applicable to polished steel, cutting instruments or tools.

153. Steam.

(*a*) Flowing steam (not under pressure). Flowing steam (not under pressure) when applied under suitable conditions is an efficient disinfecting agent. The exposure must be continued thirty minutes after the temperature has reached 100° C.

(*b*) Steam under pressure without vacuum. Steam under pressure will sterilize, provided that the process is continued twenty minutes after the pressure reaches 15 pounds per square inch. The air must be expelled from the apparatus at the beginning of the process. If impracticable to obtain the designated pressure, a longer exposure will accomplish the same result.

(*c*) Steam under pressure with vacuum. Steam in a special apparatus with vacuum attachment is the best method of applying steam under pressure, the object of the vacuum apparatus being to expel the air and to promote the penetration of the steam. The process is to be continued for twenty minutes after the pressure reaches 10 pounds to the square inch.

GASEOUS DISINFECTANTS.

154. Sulphur dioxide. Sulphur dioxide is efficient, but requires the presence of moisture. It is only a surface disinfectant, and is lacking in penetrating properties. An atmosphere containing 4.5 per cent can be obtained by burning 5 pounds of sulphur per 1,000 cubic feet of space. This amount would require the evaporation or

volatilization of about 1 pint of water. Under these conditions the time of exposure should be not less than twenty-four hours for bacterial infections. A shorter time will suffice for fumigation necessary to kill mosquitoes and other vermin.

155. The sulphur may be burned in shallow iron ovens (Dutch ovens) containing not more than 30 pounds of sulphur for each pot, and the pots should stand in vessels of water. Quicker and better results can be obtained from burning the same total amount of sulphur in a number of small shallow ovens (Dutch ovens), 5 to 10 pounds in each, than in a few large ovens. The sulphur ovens should be elevated from the bottom of the compartment to be disinfected in order to obtain the maximum possible percentage of combustion of sulphur. The sulphur should be in a state of fine division, and ignition is best accomplished by alcohol; special care to be taken with this method to prevent damage to cargo of vessel by fire; or the sulphur may be burned in a special furnace, the sulphur dioxide being distributed by a power fan. This method is peculiarly applicable to cargo vessels.

156. Liquefied sulphur dioxide may be used for disinfection in place of sulphur dioxide generated as above, it being borne in mind that this process will require 2 pounds of the liquefied gas for each pound of sulphur as indicated in the above paragraphs.

157. Sulphur dioxide is especially applicable to the holds of vessels, or to freight cars and apartments that may be tightly closed and which do not contain objects injured by the gas. Sulphur dioxide bleaches fabrics or materials dyed with vegetable or aniline dyes. It destroys linen or cotton goods by rotting the fiber through the agency of the acids formed. It injures most metals. It is promptly destructive to all forms of animal life. This property renders it a valuable agent for the extermination of rats, insects, and other vermin.

FORMALDEHYDE GAS.

158. Formaldehyde gas is effective if applied by one of the methods given below. Formaldehyde gas has the advantage as a disinfectant that it does not injure fabrics or most colors. It is not poisonous to the higher forms of animal life. It fails to kill vermin, such as rats, mice, roaches, bedbugs, etc. The method is not applicable to the holds of large vessels. Formaldehyde is applicable to the disinfection of rooms, clothing, and fabrics, but should not be depended upon for bedding, upholstered furniture, and the like, when deep penetration is required.[a]

159. Many formaldehyde solutions do not contain 40 per cent of formaldehyde, and all are apt to deteriorate with time. It is there-

[a] It should be noted that formaldehyde disinfection is more efficient in warm, moist, or still weather than in cold, dry, or windy weather.

fore necessary to use a quantity in excess of the amount prescribed in these regulations, unless the solution has been recently analyzed.

160. The following methods of evolving the gas may be used:

(*a*) Autoclave under pressure, three to twelve hours' exposure.

(*b*) Lamp generator, six to eighteen hours' exposure.

(*c*) Spraying, twelve to twenty-four hours' exposure.

(*d*) Formaldehyde and dry heat in partial vacuum, one hour's exposure.

(*e*) Chemical, as formalin-permanganate method of Russel, (see par. 166); formalin-aluminum sulphate-lime of Walker, (see par. 166).

161. The minimum number of hours' exposure as given above applies to empty rooms of tight construction containing smooth, hard, surfaces; the maximum number of hours' exposure applying in all cases to textiles and other articles of a similar kind requiring more or less penetration.

162. Autoclave under pressure. This method has considerable penetrating power when applied as detailed below. Rooms or apartments need no special preparation beyond the ordinary closing of doors and windows. Pasting, caulking, or chinking of ordinary cracks and crevices is not necessary. The doors of lockers and closets and the drawers of bureaus should be opened. In this apparatus use formalin (40 per cent), with the addition of a neutral salt, such as calcium chloride (20 per cent). The gas must be evolved under a pressure not less than 45 pounds. After the gas is separated from its watery solution the pressure may be allowed to fall and steam projected into the compartment to supply the necessary moisture. Use not less than 10 ounces of formalin per 1,000 cubic feet, and keep the room closed for three to twelve hours after the completion of the process. For large rooms the gas must be introduced at several points as far apart as possible. It is applicable to the disinfection of clothing and fabrics suspended loosely in such a manner that every article is freely accessible to the gas from all directions.

163. Lamp or generator. This method requires an apparatus producing formaldehyde by a partial oxidation of wood alcohol, and in using it the room or apartment should be rendered tight as practicable. Oxidize 24 ounces of wood alcohol per 1,000 cubic feet, and keep the room closed for six to eighteen hours, in accordance with the provisions of paragraph 160. This method leaves little or no odor. When applied to clothing and textiles, the articles should be suspended in a tight room and so disposed as to permit free access of the gas. (See also par. 161.) The wood alcohol should be of 95 per cent strength, and should not contain more than 5 per cent of acetone.

164. Spraying. The formalin (40 per cent) should be sprayed on sheets suspended in the room in such a manner that the solution

remains in small drops on the sheet. Spray not less than 10 ounces of formalin (40 per cent) for each 1,000 cubic feet. Used in this way a sheet will hold about 5 ounces without dripping or the drops running together. The room must be very tightly sealed in disinfecting with this process, and kept closed not less than twelve hours. The method is limited to rooms or apartments not exceeding 2,000 cubic feet. The formalin may also be sprayed upon the walls, floors, and objects in the rooms.

This method is markedly interfered with and is not to be relied on at low temperatures, say, below 72° F. At 43.5° F. very little formaldehyde is liberated, the formaldehyde being polymerized on the sheets.

165. Formaldehyde with dry heat in partial vacuum. This method has superior penetrating powers and is specially applicable to clothing and baggage. The requirements of this method are (1) dry heat of 60° C. sustained for one hour; (2) a vacuum of 15 inches; (3) formaldehyde evolved from a mixture of formalin with a neutral salt, in an autoclave under pressure, using not less than 30 ounces of formalin (40 per cent) for 1,000 cubic feet; and (4) a total exposure, under these combined conditions, of one hour.

166. Chemical, as—

(1) Formalin permanganate method. When formalin is poured over crystals of permanganate of potash, a vigorous reaction takes place, and a large quantity of formaldehyde gas is liberated. Reaction is over in a short time, five minutes, and if a proper proportion of substances is used, the residue is almost dry. The proportion is 2 pints of formalin to 1 pound of permanganate of potash. One pint of formalin for 1,000 cubic feet of space, should be used if the temperature is 60° F. or less, a less amount may be used for higher temperatures, but not less than 10 ounces per 1,000 cubic feet. This method is extremely efficient on account of the rapidity with which the gas is liberated, but the danger of fire should be guarded against, as the formaldehyde gas, being in a comparatively dry state, is inflammable in the presence of a light, such as lighted matches, lamp, etc.

(2) Formalin-aluminum sulphate-lime method. Add 1 part sulphate of aluminum to 2 parts of hot water. One part of this solution is added to 2 parts of formalin (both by volume). One part of this second solution is poured on 2 parts of unslacked lime (quick lime), broken into small particles. The process of liberation of formaldehyde gas is completed in about twenty minutes. This method is not as efficient as the previous one, as less than half the amount of formaldehyde gas is yielded from the same amount of formalin.

Two pints of formalin per 1,000 cubic feet of space should be used, if the temperature is 60° F. or less.

Fire should be guarded against, but this danger is decidedly less than in the permanganate process on account of the large amount of water vapor coming off with the gas.

167. The stated times of exposure to sulphur dioxide and formaldehyde are sufficient to destroy bacterial infection due to non-spore-bearing organisms, providing that the infection is present on the surface. If the room is of peculiar construction, so as to impede the diffusion of the gas, or if the room is a dirty one, or if on account of any other condition rendering the germicidal action of the gas more difficult, the time of exposure should be proportionately increased, or supplanted by other methods.

CHEMICAL SOLUTIONS.

168. Bichloride of mercury. Bichloride of mercury is a disinfectant of undoubted potency and wide range of applicability. It can not be depended upon to penetrate substances in the presence of albuminous matter. It should be used in solutions of 1 to 1,000. The solubility of bichloride of mercury may be increased by using sea water for the solution, or by adding 2 parts per 1,000 of sodium or ammonium chloride to the water employed.

169. Carbolic acid. Carbolic acid in the strength of 5 per cent (see par. 52) may be substituted for the bichloride of mercury, and should be employed in the disinfection of the cabins and living apartments of ships to obviate injurious action on polished metals, bright work, etc.

170. Formalin. Formalin containing 40 per cent of formaldehyde may be used in a 5 per cent solution as a substitute for bichloride of mercury or carbolic acid, and is useful for the disinfection of surfaces, dejecta, fabrics, and a great variety of objects, owing to its noninjurious character.

APPLICATION OF DISINFECTANTS IN QUARANTINE WORK.

171. Hold of iron vessels, empty, shall be disinfected by either:

(a) Sulphur dioxide generated by burning sulphur 5 pounds per 1,000 cubic feet of air space, or liberated from 10 pounds of liquid sulphur dioxide, sufficient moisture being present in both cases; time of exposure, twenty-four hours. (See par. 154.)

(b) Washing with a solution of bichloride of mercury, 1:1,000.

172. Holds of wooden vessels, empty, shall be disinfected by—

(a) Sulphur dioxide in the manner prescribed above, followed by

(b) Washing with a solution of bichloride of mercury.

173. Holds of cargo vessels, when cargo can not be removed, shall be disinfected in so far as possible by sulphur dioxide not less than 4 per cent per volume strength, and where possible this should be generated from a furnace to minimize danger of fire in cargo.

174. Living apartments, cabins, and forecastles of vessels shall be disinfected by one or more of the following methods:

(*a*) Sulphur dioxide, the destructive action of the gas on property being borne in mind.

(*b*) Formaldehyde gas.

(*c*) Washing with solution of bichloride of mercury, 1:1,000, or 5 per cent solution of formalin, or 5 per cent solution of carbolic acid, preference being given to carbolic acid for application to polished woods, bright metals, and other objects injured by metallic salts.

The forecastle, steerage, and other living apartments in bad sanitary condition must be disinfected by method (*a*) followed by method (*c*).

175. Mattresses, pillows, and heavy fabrics are to be disinfected by—

(*a*) Boiling.

(*b*) Flowing steam, i. e., steam not under pressure.

(*c*) Steam under pressure.

(*d*) Steam in a special apparatus with vacuum attachment.

176. Clothing, fabrics, textiles, curtains, hangings, etc., may be treated by either of the above methods from (*a*) to (*d*) inclusive, as circumstances may demand, or by formaldehyde gas or sulphur dioxide where the article is of a character which will not be damaged by sulphur dioxide.

177. Articles injured by steam, such as leather, furs, skins, rubber, trunks, valises, hats and caps, bound books, silks, and fine woolens should not be disinfected by steam. Such articles should be disinfected by formaldehyde gas or by any of the agents allowed in these regulations which may be applicable thereto. Those which will be injured by wetting should be disinfected by a gaseous agent.

178. Clothing, textiles, and baggage, clean and in good condition, but suspected of infection, can be efficiently and least injuriously disinfected by formaldehyde gas, generated by one of the methods prescribed in paragraph 160—(*a*), (*b*), or (*d*).

179. Textiles which are soiled with the discharges of the sick or presumably are deeply infected must be disinfected by—

(*a*) Boiling.

(*b*) Steam.

(*c*) Immersion in one of the germicidal solutions.

180. Cooking and eating utensils are always to be disinfected by immersion in boiling water or by steam.

AGENTS FOR THE DESTRUCTION OF MOSQUITOES, RATS, AND OTHER VERMIN, AND THEIR APPLICATION TO QUARANTINE WORK.

181. Sulphur dioxide—obtained as described in paragraphs 154 and 155—destroys all animal life.

182. In the case of vessels, when treated for yellow fever infection, the process shall be a simultaneous fumigation with sulphur dioxide,

2 per cent volume gas, and two hours exposure, in order to insure the destruction of mosquitoes.

183. In the case of vessels when treated for plague the process with sulphur dioxide shall be as follows:

Without cargo: The simultaneous fumigation with sulphur dioxide gas not less than 2 per cent for six hours' exposure.

With cargo: Fumigation with sulphur dioxide gas, 4 per cent, six to twelve hours' exposure, according to stowing.

Infected vessels may require partial or complete discharge of cargo, and fractional fumigation for efficient deratization.

184. Pyrethrum. The fumes of burning pyrethrum may be used to destroy mosquitoes in places where there are articles liable to be injured by the use of sulphur.

Four pounds per 1,000 cubic feet space for two hours' exposure with this amount all or practically all of the mosquitoes will be killed, but precautions should be taken to sweep up and destroy any that may have escaped.

Pyrethrum stains walls, paper, etc.

185. The oxides of carbon, as used at Hamburg, are efficient to destroy rats but do not kill fleas or other insects. They are obtained by burning carbon, coke, or charcoal, in special apparatus, and the gas as produced consists of about 5 per cent carbon monoxide, 18 per cent carbon dioxide, and 77 per cent nitrogen.

Twenty kilos of carbon, coke, or charcoal are used for every 1,000 meters of space. The gas is allowed to remain in the ship for two hours and from seven to eight hours are allowed for it to leave it. This is about equivalent to 1¼ pounds of carbon (coke) to 1,000 cubic feet of air space. As this gas is very fatal to man and gives no warning of its presence, being odorless, a small amount of sulphur dioxide should be added to give warning of its presence. As it does not kill fleas it can not be depended on for complete work, where there is evidence of plague among rats on the vessel, as the infected fleas would infect the rats coming aboard after the deratization.

186. The articles named as disinfectants which can obviously destroy animal life can be used for that purpose when applicable, as steam for bedding, fabrics, etc. Formaldehyde is not applicable for this purpose.

187. Where both disinfection and destruction of vermin are required for mattresses, pillows and fabrics, the use of steam meets both requirements, and is especially applicable.

188. Hydrocyanic acid gas is fatal to all forms of animal life and is not injurious to any material. It is best generated by mixing—

Cyanide of potash	4
Sulphuric acid	6
Water	9

The acid should first be diluted, which must be done in some vessel capable of withstanding the heat. The whole amount of the cyanide of potash must be put in the acid at once, and as the evolution of the gas is very rapid, the operator must be prepared to leave immediately. Fulton advises that the cyanide be tied in a bag, to be lowered into the acid by a cord passing outside of the room.

About 10 ounces of cyanide of potash per 1,000 cubic feet.

It is of course applicable when necessary to destroy mosquitoes or vermin (particularly in living quarters), but is too dangerous to be used except by those experienced in its use.

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TREASURY DEPARTMENT

Public Health and Marine-Hospital Service of the United States

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THE RELATION OF CLIMATE TO THE TREATMENT OF PULMONARY TUBERCULOSIS

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THE RELATION OF CLIMATE TO THE TREATMENT OF PULMONARY TUBERCULOSIS.

By Passed Asst. Surg. F. C. Smith.

Tuberculous patients are sometimes puzzled by conflicting medical advice on the subject of climate in its relations to the treatment of their disease. It is not surprising that diverse opinions prevail. From very early times the cure of tuberculosis has been associated, more or less, with certain places, and, as Klebs says: "At one time or another, almost any combination of known atmospheric conditions was considered to constitute a climate which had protective or curative qualities for consumptives." The reason for this is found, of course, in the fact that pulmonary tuberculosis is a chronic disease, depending for arrest upon a large number of factors, many of which are independent of atmospheric conditions and common to all climates.

Another thing which has added to the confusion of ideas on the subject has been the search for "immune zones," regions where tuberculosis is rare or absent, the inference being implied that such places offer climatic conditions useful in treating the disease. No region, however, has long continued free from tuberculosis after being reached by modern civilization. Remote districts became infected rapidly as soon as the disease was introduced. Thinly populated areas, whatever their geographical position, become tubercularized wherever cities are built and confining trades established. Latham states that tuberculosis is rife amongst the watchmakers of the high Alps. The death rate from tuberculosis among our native Indians is not appreciably less in those tribes which have always lived in the arid Southwest and other favorable climates. Neither the salts in sea air, the ozone of forests, nor the rarefied atmosphere of mountains are remedial in themselves; they simply typify an outdoor life. Physicians are practically agreed that there is no specific climate for tuberculosis.

But, beyond all question, an open-air life is more pleasant in some climates than in others, and an open-air life in varying degrees of rest and activity is one of several important elements in the

proper treatment of tuberculosis. The gain in comfort and thoroughness with which an outdoor existence can be followed in selected climates and the relation of certain complications to special atmospheric conditions must be considered against a possible loss in the facilities with which other essential therapeutic measures will be carried out.

The following expressions are representative of recent medical opinion.

Dr. E. R. Baldwin, Saranac Lake:

Change of climate is often of great value, but is not a necessary thing in all cases. It is largely dependent upon the means of the patient and also upon the environment at home. A change to a higher altitude and a more invigorating atmosphere is nearly always advantageous where the means are sufficient and proper supervision can be obtained. Experience shows that a minimum of $10 a week is required for the expenses of patients in most of the health resorts, unless they can enter a semicharitable sanatorium. Hence it is inadvisable for patients who are unable to command the above sum to leave home.

Hillier, of London:

Climates of every variety have at one time and another been recommended for consumption: High altitudes and the seaboard, warm climates and cold ones, the ocean and the desert, the equator and the poles. The underlying truth is at last being recognized. The chief virtue of these resorts is the open-air life.

Dr. Lawrence Flick, Henry Phipps Institute, Philadelphia:

Expert medical advice is the most important factor in effecting a cure, and doctors at home are now as well up on the disease as doctors at climatic resorts, though formerly this was not so. A long period of treatment is required, no matter where undertaken, and proper treatment at a distant resort is prohibitive for the poor, and often embarrassing for the well to do. I desire to go on record as believing that there is no therapeutic value in climate.

Anders, of Philadelphia (Practice of Medicine, 1907):

Experience and observation have shown that certain climates, selected with particular reference not only to the stage of the affection, but more particularly to the individual, are useful modifying influences of the tissue soil. In any case of tuberculosis that climate is most suitable in which the patient "feels well, eats well, sleeps well, and gains flesh and strength." (Delafield.)

Latham, of London (Diagnosis and Modern Treatment of Pulmonary Consumption):

The results of sanatorium treatment in a variety of climates have shown that the old ideas of a particular climate or altitude being a specific for pulmonary consumption are erroneous, and have proved that climate is only one, though an important, factor in the treatment. Most physicians who have had much experience of sanatorium treatment, and who have watched patients for some years after their return from a sanatorium, agree that as far as possible *all patients should be treated under the same climatic conditions as those which they are likely to experience in their subsequent life.* (Italics are Latham's.)

Minor, of Asheville, N. C., in an article for popular use:

If you have money enough to go away to a favorable climate and get there good board, care, and accommodations, it will be a great help to you; but *change of climate is not the first or most important thing,* and, unless you have money enough to get in the climatic resort as good or better conditions than you have at home, you had much better stay at home and spend what money you have in getting the best possible conditions you can there. (Italics are Minor's.)

Walsh, of Philadelphia:

If a case of consumption can not be cured in its home climate, it can not be cured anywhere.

Osler (Practice of Medicine, 1907):

(c) *Climatic treatment.*—This, after all, is only a modification of the open-air method. The first question to be decided is whether the patient is fit to be sent from home. In many instances it is a positive hardship. A patient with well-marked cavities, hectic fever, night sweats, and emaciation is much better at home, and the physician should not be too much influenced by the importunities of the sick man or his friends.

* * * * * * *

Very much is said concerning the choice of locality in the different stages of pulmonary tuberculosis, but when the disease is limited to an apex, in a man of fairly good personal and family history, the chances are that he may fight a winning battle if he lives out of doors in any climate, whether high, dry, and cold or low, moist and warm.

Dunham, 1904, after visiting discharged Massachusetts Sanatorium patients in the West, and upon comparing Massachusetts Sanatorium statistics with those of the United States Army Sanatorium at Fort Bayard, New Mex.:

The results corroborate our belief in the efficacy of residence in dry climates, but with a smaller margin in its favor than was anticipated. * * *

The proportion of people adapted for treatment in these extremes of climate must be more nearly equal than thought possible by climatologists generally. That is to say, a small majority of the patients at Rutland would probably do better at Fort Bayard and a large minority there might do better here.

Francine, of Philadelphia (Pulmonary Tuberculosis, 1907):

At first and for a considerable time mountainous regions or high altitudes were considered essential sites for sanatoria, as the potency of climate per se was exaggerated or at least not rightly understood. Nor can this question be considered settled even to-day, though it seems probable that the importance of the other factors in sanatorium treatment, i. e., rest, fresh air, diet, and regular regimen, are receiving juster appreciation than heretofore. The feeling seems to be gaining ground in the profession that it is not so much a particular climate which accomplishes results as it is fresh air, and plenty of it, in association with the other factors of modern treatment. * * * The view is held by some with wide experience to substantiate their claims that change of climate is unnecessary and even unadvisable and that quite as good results may be obtained by treating the patient in his own home; these latter enthusiasts have swung completely over, and disregard climate while emphasizing the importance of care and treatment. It seems probable that the just view lies somewhere midway between these two extremes.

Bonney, of Denver:

The prevailing tendency to provide home sanatoria for all classes and repudiate established facts of climatic influence is to be deplored. Climate is a valuable adjuvant to other measures of therapeutic management, but the same watchful observation by an expert physician is necessary for good results. Choice of a climate is a delicate and important matter. In all cases climatic selection becomes for the patient a question of individual fitness. The last 313 cases coming under my personal observation in Denver included 90 of doubtful diagnosis and 125 others unsuitable for the change of climate on account of the complications or advanced and rapidly progressing disease.

Pottenger, of Monrovia, Cal.:

Given the same treatment, climate is valuable. Patients of small means should remain at home under intelligent guidance instead of stinting themselves in a better climate. Favorable climate is not essential, but it makes the cure easier, and at the same time favors it.

Bowditch, V. Y., of Boston:

* * * Equally foolish to say that it is no longer necessary to send patients to a distant clime or that every patient must go far away to regain health.

Knight, of Boston (deceased):

Undoubtedly there is something in climate influences. Am sure there can be no contention as to the advantages of certain forms of climatic treatment in connection with other methods of personal hygiene.

Knopf, of New York:

The value of certain climatic regions in the treatment of pulmonary tuberculosis, particularly of high and dry climatic resorts, must be acknowledged. A change of climate is nearly always good, except in the very latter stages of the disease, when it should only be made in case of a well-to-do patient and upon his expressed desire. Even a change from a good to a seemingly less favorable climate may accomplish a certain amount of good. The danger of relapse is greater to those returning from distant resorts after a short sojourn, before they have become thoroughly acclimated or their disease cured or arrested. Suitable and beneficial differences are not infrequently found in climates very near home. Thus, for example, a removal from New York slums to North Brother Island, within the city limits, constitutes a climatic change beneficent to the majority of indigent cases.

In the selection of climate for a tuberculous patient, his likes or dislikes for warm or cold weather, or his possible idiosyncrasies for high or low altitude, and the presence of chronic dry or moist nasal catarrhs must be taken in consideration, those with dry catarrhs usually doing better in relatively moist regions and vice versa. The majority of tuberculous patients (particularly those coming from the laboring classes) should, if at all possible, be treated in climates where they will have to live and labor after their restoration to health.

THE IMPORTANCE OF CLIMATE COMPARED WITH THAT OF OTHER THERAPEUTIC MEASURES.

The most important factors in promoting recovery from pulmonary tuberculosis are:

1. *Adequate and intelligent rest,*

2. *Proper and sufficient food,*
3. *Abundance of pure air,*

all under the direction of skilled medical service, constituting a well-ordered hygiene. It would be difficult to name the relative values of these factors. No one of them is essential in all cases, for recoveries occur under very unhygienic conditions. Various pathologists estimate that 50 per cent, or even more, of infected people recover without knowing that they have had a serious disease. But for those who come to a doctor and in whom the disease is discovered, such spontaneous recoveries must be ignored, and rest, food, and air prescribed according to the patient's finançial condition.

Obviously all are not equally able to afford these things. Comparatively few of those suffering from tuberculosis can realize ideal conditions for recovery. A limited purse can procure rest for a limited time, or in inadequate degree, and fresh air is often expensive just as is choice food. Fresh air is expensive in the city, because it means proper housing in a good location. How much that costs in a city like New York, for instance, is readily understood. Removal from the city entails an initial expense, with, perhaps, business sacrifices for the earning member of the family. Additional clothing required to protect the body from cold adds to the expense of fresh air. Just as the circumstances of a patient may prevent him from securing the best house or the best food, so he may not be able to get the best fresh air, i. e., the best climate. If we grant that there are differences in climates, just as there are differences in houses, still, excellence of climate is no more essential to a cure than excellence of some other things, and there is no climate so good that it will always make up for increased work or poorer housing, or scantier fare, if necessitated by a change.

Each case should be decided on its own merits, and where sacrifices must be made they should be duly apportioned, both in regard to the immediate and also the remote aspects of the case. For one with fever, sweats, and rapid wasting, absolute rest in bed, with good ventilation and good nursing, is an immediate necessity, outweighing other considerations. On the other hand, unfavorable climatic conditions, such as oppressive heat, irritating dust or smoke, extreme cold, or an atmosphere of melting snow and constant fog may exercise such a bad effect on a case fit to travel that a suitable change of climate becomes an urgent necessity and should be undertaken, even at considerable sacrifice.

The wealthy, who are able to surround themselves with comforts and can command expert service wherever they go, may seek a change whenever it is indicated, weighing only the ill effects of a journey against the natural advantages of the place selected. Besides the wealthy, there is a class following occupations which allow a transfer

from one region to another with little sacrifice of means. Railroad employees in certain capacities, telegraph operators, etc., and government employees in some departments, are often able, by the courtesy of their superiors, to effect a transfer of their duties to a climate more favorable to themselves or to a tuberculous member of their family. The three great medical services of the Federal Government, the Public Health and Marine-Hospital Service and the medical departments of the army and navy, have selected for their respective sanatoria locations in the arid Southwest, in what was adjudged the most suitable climate for young, adult males. But in locating state and municipal sanatoria the governing boards have in each instance chosen a site within their own domain; economic considerations, accessibility, and opportunities for administrative control outweighing any increased therapeutic value a distant climate might have afforded. The majority of patients will be in the same relation to their families that the public sanatorium bears to its State and the same economic principles will usually apply to the disposition of the case.

PRELIMINARY OBSERVATION AND STUDY OF CASE BEFORE ADVISING CHANGE OF CLIMATE.

As a routine procedure, the practice of advising a change of climate to a distance is unwarranted. The consensus of opinion is that certain changes are desirable in certain cases, but precipitate haste in ordering a patient away is a mistake. Sometimes a change is either unnecessary or useless, and moreover, a climate adapted to the needs of one individual may be wholly unsuited to those of another.

The doctor who habitually prescribes a distant removal is usually one who still harbors the idea that there is a specific climate for tuberculosis. Such a physician is an exponent of some particular region, from fashion or caprice or from lack of knowledge of other places. The old adage "Consumption, therefore, creosote or Colorado" is equally expressive of therapeutic and climatic ignorance. The reproach so frequently heard from resort specialists that patients are not sent early enough, that the family doctor holds them too long, has probably done more harm than good. The case that should be sent to a distant climate immediately upon diagosis is exceptional, nor should neglect to make an early diagnosis stand sponsor for precipitate haste in sending the victim away when it is finally established. At the Marine-Hospital Sanatorium, Fort Stanton, N. Mex., the results have been nearly three times as good in the cases which left the home stations, i. e., the local marine hospitals, without fever, as in those who had a temperature of 38 degrees or more within two weeks of departure. The deaths in those leaving afebrile were to [illegible] leaving with fever, as 22 to 59, the arrests as 19 to 7½, the ap-

parent cures as 10 to 3. (Nomenclature of the National Association in use at this station.) A period of observation is frequently desirable in order to exclude hopeless cases, and that an intelligent selection of climate may be made if a change is needed, the character of each case offering its individual indications.

But there should be no delay in instituting the regimen upon which a cure will depend, no matter where undertaken, whether a removal is contemplated and whether the time set for departure is near or remote.

HOPELESS CASES NOT TO BE SENT TO A DISTANCE.

It is not always easy to determine when a case of pulmonary tuberculosis is hopeless, but in general the far advanced case that does not offer some hope of temporary arrest in the home climate, when treated in a local sanatorium, or under other favorable conditions, can not be expected to improve under the same conditions after a long journey, no matter what the difference in climate. A progressing case of long standing, with abdominal organs already damaged by terminal changes of the disease, and dependent on nursing for comfort, is in no condition to be benefited by a change of climate. Occasionally a critical case recovers or life is prolonged beyond all expectation in a health resort, but the same thing occurs in similar cases in home climates. In the elevated western regions, so frequently selected, a patient grows worse faster or improves faster, as the case may be, than in less stimulating climates. At the Marine-Hospital Sanatorium, Fort Stanton, N. Mex., there were 84 deaths within one month of arrival, and 203 in from one to six months after arrival, out of a total of 524 deaths. It makes little difference to a dying man what the climatic conditions are so long as he has proper care. A few hours of extra sunshine per day or a decreased amount of precipitation have not the same value to a moribund case that they have to one less ill. Unfortunately, the evil results of exiling the hopeless cases are not so apparent to those responsible for it as to those among whom the unhappy sufferers go, for there is no picture more miserable than the boarding-house life of a consumptive, hopelessly ill among strangers. An inquiry made by the National Association for the Study and Prevention of Tuberculosis has convinced its executive office that over 7,000 hopelessly ill consumptives are annually sent to the States of California, Arizona, New Mexico, Texas, and Colorado, and that of these over 4,000 are practically indigent.

THE PSYCHOLOGICAL MOMENT FOR CHANGE.

Almost any case of tuberculosis which may be expected to result favorably, as well as many hopeless cases, will, when kept in bed in

freely flowing air anywhere, improve for a time and up to a certain point.

As a rule, indeed, routinely, it is best to carry the patient as far along the road to health as seems possible (within certain limits) by treatment at home, at least to relieve all symptoms so far as may be, before contemplating a change. After comparative quiescence of the lung process has been reached under treatment at home, and the nutrition is much improved, there comes a stage where further improvement is slow. This is the psychological moment for change. In speaking of change I mean a complete change to health resorts in the far West; or those in the East at considerable distance from the patient's home. (Francine.)

It can not be too frequently repeated that each case must be decided individually. A delicate, anemic woman who feels the cold keenly and can not be trained to face veranda life in the damp rigors of a New England winter, is so much benefited by a sojourn of three months in some southern winter resort where outdoor life can be comfortably followed that the advantages of the temporary change outweigh the pangs of homesickness. One with flagging digestion and relaxed nervous and vascular system, sweltering in the heat of a southern July, may find a removal to the sparkling air of some elevated western region or even to the invigorating atmosphere of a cool beach resort a life-saving measure.

GENERAL ASPECT OF THE INVASION.

The amount of lung tissue involved is by no means the only thing to be considered. Frequently the finding of tubercle bacilli in the sputum of a man coming to his physician with no serious symptoms causes the case to be referred to a specialist in diseases of the chest who elicits the history of an unrecognized attack of tuberculosis occurring several years previously, and finds, clinically, an arrested process. The pathological condition may correspond to that of a case just returned from a successful period of climatic treatment. Obviously, such a newly diagnosed case is not subject to the same rules as certain others. Again, the presence of a small area of active disease in one part of a lung, showing arrest in other parts, may put the case in the same class as an incipient attack. Or the presence of terminal changes, fatty kidney, amyloid liver, etc., from long standing tuberculosis, may put a case with even a slight degree of activity in the class with those hopelessly ill. Moreover, certain types are florid from their onset, the so-called pneumonic cases, as well as the miliary variety, and it is certain that the influence of climate is practically negligible in such acutely progressing disease. For certain complications, skillful treatment by an appropriate specialist is so important that all other considerations may be disregarded for the time and the most skillful service sought, regardless

of climate. In general it may be said that any complication which confines the patient to bed is best met where the best nursing facilities are to be found.

THE LOCAL SANATORIUM.

A preliminary observation for a few months in a local sanatorium is invaluable in determining the character of a recently diagnosed tuberculosis. The number of these institutions is increasing almost daily and within a few miles of any large city will be found charitable, semicharitable, and private fresh-air hospitals for any class of cases. Here an idea of the resistance of the individual and the indications to be met can be obtained. The habits of life which that consumptive must observe who will either live with or cure his disease in any climate are best learned in such an institution where the inmates are devoted to the business of getting well. There is, in a well-ordered sanatorium, an esprit de corps among the patients themselves, an intelligent, buoyant, helpful cooperation not altogether unlike college spirit, and the special training afforded in a vital matter in such a place may well liken the sanatorium to a school, as, indeed, it is. North Carolina has recently changed the name of her state sanatorium to the State Training School for Tuberculosis.

The position of a specialist in diseases of the lungs is analogous to that of a surgeon, and for the best results the former should often be consulted just as, in another class of diseases, the latter would be. A surgeon, competent for ordinary emergencies, can be found in any, even the smaller cities, but while special training in pulmonary tuberculosis is rapidly developing and in a few years will be easily available in any part of the country, it has now often to be sought for in special places, and the sanatorium is one of these.

THE GENERAL PRACTITIONER'S POINT OF VIEW.

The family doctor, having made a skillful diagnosis, absolute or provisional, is immediately confronted with the question, what are the best opportunities for recovery which this patient's means will allow? For, as Edson says, "the best he can get is what we must order, both as regards food, bedroom, and quality of air." If the case is in a family of wealth, his task is simplified, as he has merely to decide whether a change of climate is necessary or justifiable and the nature of the change indicated, and may give his advice accordingly, knowing that adequate means will everywhere command skilled service, home comforts, solace, and diversion. In the vast majority of cases, however, he must weigh the benefits of a change against certain sacrifices usually necessary to effect it, and here must be considered

a multitude of details, some of which the family doctor is in a position to decide upon better than anyone else and some of which, without special training in tuberculosis, he will make a mistake in attempting to decide. Even when treatment in the home climate has been decided upon, there are some who insist that their patient enter a local sanatorium for several months for the preliminary training necessary to a successful regimen at home.

If the case has a favorable outlook and a good chance to recover in the home climate, the fact often remains that there would be a still better chance in some other climates. He desires to prescribe nothing short of the very best conditions. He recalls too, that a "change of climate" is time-honored advice, the patient expects it perhaps, and there will be less responsibility for an unfavorable outcome if he gives it. He may measure the vexations of home treatment against inadequate fees, and remember that he has even been accused of mercenary motives in holding certain favorable cases for home treatment. It must be confessed that it requires considerable courage for a physician to recommend "no change," and it can be said without equivocation that the family doctor who undertakes to treat a case of pulmonary tuberculosis in a home of any kind is guided by duty and altruism and not by the financial aspects of the case. The layman, always following medical teaching of a decade previous, is more ready to do "some great thing" than to bathe seven days and nights in the week in the out-door air of home. Indications for or against a removal are found in the home itself. A nervous man or woman may need to be taken from a turbulent household of lusty children, while for a differently constituted case congenial relatives are indispensable for content. Extreme measures are sometimes necessary to get a careless patient away from helpless associates, or, on the other hand, to save an invalid from false ideas of treatment at the hands of ignorant relatives.

Moreover a multitude of counsel confuses the busy practitioner. The resort specialists, each perhaps convinced of the excellence of a particular climate by a self-cure there, urge the merits of various regions. They insist that the case be sent without delay, fix two to five years as the probable duration of treatment, and perhaps raise a question at the same time against the propriety of an ultimate return to home climatic conditions. Moreover he has been convinced that hygiene and good medical attendance are as necessary in the new climate as the old, and that the claims of a sanatorium are as strong in a distant health resort as they are in the home city.

He can recall some sad experiences of previous days when his early cases went West to "rough it," or of later ones where patients thought that they could loiter in smoky lobbies and attend the evening dances and effect a cure simply because they were breathing the

pure air, or the rarefied air, or the dry air of some widely advertised "climate."

But it is often easier to persuade a patient to enter a sanatorium at a distant resort than a similar one near home, and sometimes an adult male can be persuaded to abandon his business pursuits only by radical removal from the scene of his activities. Especially is this true of physicians. The stimulation of hope afforded by a complete change is frequently needed where a patient has met repeated reverses in his own case or has seen unfavorable outcomes in a number of friends or relatives. With all this the family doctor must study the tastes and habits of his patient. The indications for change are different for a home-loving, carefully nurtured girl than for her bachelor brother. Young adults often welcome a change, whereas one past middle life, with strong attachment for home scenes, may consider it a hardship. For the very young or the very old a removal simply for change of scene would almost never be indicated.

Temperament and previous climatic environment are important. One would not, for instance, send a Norwegian youth to the Azores nor a Creole demoiselle to winter in the Adirondacks. A thin, irritable person, who shrinks at sudden drops in temperature, would not be advised to go to Colorado, nor would a full-blooded, lusty individual ordinarily be directed to San Diego.

In deciding whether a case of pulmonary tuberculosis should have a change of climate, temporary or permanent, remote or near, the doctor must not be bound by any rule, but be guided in each case by all the attending circumstances—by the patient's age, sex, and social condition, wealth, temperament and desires, by the stage and activity of the disease and its complications. He will be influenced by the home climate and the season of the year, but it is safe to say that no place is so unfavorably situated that a general recommendation for change can be made, and none so fortunate in its location as to preclude the possibile advisability of a removal.

HOME CLIMATES.

Local weather conditions at certain seasons may strongly indicate a temporary removal from some localities. When crowds of well people press out of a hot city to the nearest cool resort the doctor may well cast about for similar relief for his consumptives. The most frequently indicated change is one to avoid excessive heat, for it is now realized that, making allowance for idiosyncracy, cold air is especially stimulating to metabolism and, therefore, peculiarly suitable to the treatment of pulmonary tuberculosis. The tonic effects of cold air with increased appetite and power of assimilation account for much of the good results ascribed to the dryness and elevation of

Colorado. Most city dwellers know of some near-by country resort where comfort is increased during the summer months, and, with the consumptive, as with others, comfort is the chief motive for a change. There are few parts of the United States so situated as not to have within comparatively short distances places with climatic conditions so different as to constitute a marked change, and as J. C. Wilson has said, "It is sometimes not so much the climate to which the patient goes as the climate from which he is taken." The change from a hot city to a cool country place may be as radical as a removal from a suburban mansion to New Mexico plateaus.

Within a few hours' ride of any large city can be found comfortable resorts. The mountains of the Virginias and Pennsylvania are especially rich in places where, with proper medical attendance, favorable climatic conditions for consumptives are found. The climate of the Adirondacks is only representative of the wooded country of that latitude. Almost every State on the Canadian border has forests at moderate elevations where, with only occasional extremes of temperature, a stimulating atmosphere lends comfort to an outdoor life.

The Central Plateau of Massachusetts, described by Getchell, of Worcester, embraces 700 square miles and bears a score of small cities, all at an altitude of 1,000 feet or more. In one of these, Rutland, the state sanatorium is located, and from this place, as well as from Petersham and Templeton, Mount Greylock in the Berkshires, 60 miles away, can be plainly seen (Doctor Getchell estimates) as many as sixty days in the year. In view of the accessibility of this region and the excellent results obtained at the state institution, it is gratifying that numerous private sanatoria are being opened there.

Ulster, Greene, and Sullivan counties around New York city are frequently mentioned as containing many desirable locations for consumptives. Judd, of Philadelphia, describes a plateau 1,800 to 2,000 feet high in Monroe County, Pa., conveniently near several of the largest eastern cities, and, as is well known, there are hundreds of cool beach resorts from Maine to far south on the Atlantic seaboard. Asheville, N. C., well known as a health resort, is illustrative of the stimulating climate of the mountainous regions of North Carolina, Tennessee, and Kentucky.

Moreover, it should be remembered that there is no ideal all-the-year-round climate for the average consumptive. Physicians of Denver sometimes send patients out of that city into neighboring mountains during certain months of the year to avoid unfavorable weather conditions. Craig, of Phoenix, suggests that all-the-year health seekers in Arizona should spend summer in Flagstaff, fall in Prescott, and winter and spring in Phoenix. Climatic conditions vary greatly within short distances, not only in California and Colorado,

but also in many Eastern States, where mountains are found near the ocean.

There are certain advantages in undertaking the cure in one's own home climate, and by this term is usually meant places not more distant, for instance, than the confines of the home State. The limitations of one's own climate are known and will not be presumed upon, whereas the faith inspired by a removal to some specially selected climate often weakens the regimen which is necessary anywhere. Moreover, a return to home climatic conditions is more apt to show a lapse from the careful hygiene which was followed with comfort in a favorable spot but seems a hardship in more rigorous climes. As Hillier says, "The man who has braved wind and weather in an English or German sanatorium will more readily stay out of doors and open his windows when he gets back to every-day life at home than one who has just returned from the Mediterranean or the cape."

The short-distance change is admirably adapted to the needs of the average individual for whom a removal from business cares or unfavorable home surroundings is indicated. It is probable that the advantages of near-by resorts have not been fully realized by busy, general practitioners, and the therapeutic value of such changes has been lost sight of in radical removal to a distant climate. But climatic therapeutics are not exact. Indeed, as Anderson, of Colorado Springs, has said, "The matter of climate is largely one of experiment." A short-distance change is obviously a less costly experiment than a long-distance change.

The following list, perhaps incomplete, showing location of various state sanatoria is added, because, when intelligently selected, such sites are representative of the healthful regions of a State. The superintendent of such a public institution is also in a position to know the location of private sanatoria in his neighborhood, and is more or less in the habit of answering inquiries concerning the tuberculosis situation in his own State.

Arkansas: Boonesville (not completed).
Delaware: In the Brandywine Hills near Wilmington.
Georgia: Alto (not yet built).
Indiana: Three miles east of Rockville.
Iowa: Five miles northeast of Iowa City.
Louisiana: Covington.
Maine: Hebron.
Maryland: Sabillasville, Towson, and Mount Airy.
Massachusetts: Rutland and North Reading.
Michigan: Howell.
Minnesota: Walker.
Missouri: Mount Vernon.
New Hampshire: Glencliffe.
New Jersey: Glen Gardner.
New York: Ray Brook.
North Carolina: Montrose.
Ohio: Mount Vernon.
Pennsylvania: Mount Alto and Cresson.
Rhode Island: Pascoag.
South Dakota: Custer (not yet built).
Vermont: Pittsford.
Wisconsin: Wales.

SPECIAL CLIMATES.

The practice of sending consumptives away to high altitudes is fraught with greater possibilities for good or for evil than any other change commonly made. Such places in the United States are dry, cool, and stimulating, with a large number of clear days and a maximum of sunshine. Concerning the therapeutic effects of diminished air pressure itself authorities differ, some holding it to be indifferent, others assigning it a positive value in dilating the air vesicles and increasing pulmonary circulation. Still others, while granting that many cases are benefited by such climates, believe that a rarefied atmosphere may be harmful in so far as the deeper breathing required is opposed to pulmonary rest and assists in breaking down existing consolidation. All agree that there is a large number of contraindications to high altitudes, and the following is a list of those for whom such a change is usually considered unadvisable: Those of low vitality and with poor circulation; the old or middle aged with declining powers of heat production; the erythric, neurotic individuals, or those with irritable temperaments; all with acutely progressing disease or those who can not attain even a temporary arrest in the home climate; very far advanced cases with much destruction of lung tissue, resulting in dyspnœa (fibroid type included); those with dilatation or nervous derangement of the heart and certain forms of uncompensated valvular disease; and cases complicated with diabetes, nephritis, emphysema, dry catarrh, or much bronchial irritability. For young adults without any of the foregoing complications who can and will secure proper medical attendance and submit to the same regimen that is necessary to effect a cure anywhere, the high, dry climate is the best. It has its dangers, one of which is the sense of well-being which may betray one into pernicious activity. It will frequently revive a jaded appetite or mitigate a troublesome moist catarrh at once, and it will add zest to life, but it will not insure recovery in every case and is not a short cut to health. Of the first 1,754 patients admitted to the Marine Hospital Sanatorium at Fort Stanton, N. Mex., 524 have died there, but a large number of these would not, in the light of present knowledge, be considered suitable cases for transfer, and it may be added that in the interest of the public health it is the policy of this institution to encourage hopeless cases to remain, unless the interests of the individual are best served by returning him to lower altitudes.

The following list of places with altitudes between 4,000 and 7,000 feet is believed to represent fairly well the high, dry climate, but is of course only suggestive of locations to be sought:

In Arizona, Flagstaff, Oracle, and Prescott;[a] in Colorado, Boulder,[a] Brush,[a] Canon City,[a] Colorado Springs,[a] Denver,[a] and Glen-

[a] Denotes location of private sanatoria.

wood Springs; in New Mexico, Alamogordo,[a] Albuquerque,[a] East Las Vegas,[a] Las Vegas, Lincoln,[a] Santa Fe,[a] and Silver City;[a] in Texas, Alpine and Marfa; and in Wyoming, Cheyenne.

At moderate altitudes in the arid Southwest are many localities characterized by all the attributes of a dry climate. During the summer months these places are less comfortable than the more elevated ones just mentioned, but the winter nights are less severe at lower altitudes. Both are about equally subject to the dust storms of this region which occur occasionally, chiefly in March and April. The following places, all at altitudes between 2,000 and 4,315 feet, typify this climate: In Arizona, Castle Creek and Tucson;[a] in New Mexico, Carlsbad, Deming, Las Cruces, and Roswell; in Texas, Boerne, and El Paso.[a]

Warmer, less stimulating, more equable, and more humid, suited (especially as winter resorts) to those less robust and adapted to the needs of some for whom elevated regions are contraindicated, regions of less than 1,000 feet elevation are exemplified in Aiken[a] and Camden, S. C.; Augusta and Thomasville, Ga.; Llano[a] and Columbus, Tex.

As typical of the warm, humid, equable climate should be mentioned Hawaii, certain parts of Florida and the coast of southern California, and as winter resorts and for those with nephritis and advanced fibroid changes, as well as for the aged and cases complicated with excessive bronchial irritability, this type of climate is useful.

No consumptive should start for a health resort without first satisfying himself that he will be able to provide himself with suitable accommodations there. Certain places, notably in Texas, have been filled with indigent cases from the East who have severely taxed the patience and resources of the residents. Generalizations on climate are never of much value and each place must be judged by itself. The National Association for the Study and Prevention of Tuberculosis publishes a directory of institutions for tuberculosis in the United States and Canada, and its official organ, The Journal of the Outdoor Life, 2 Rector street, New York, courteously states that its service department "will furnish, without charge, information about sanatoriums, boarding houses, health resorts, and such other data as it has on file."

[a] Denotes location of private sanatoria.

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TUBERCULOSIS
ITS NATURE AND PREVENTION

BY

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PREPARED BY DIRECTION OF THE SURGEON-GENERAL

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TUBERCULOSIS: ITS NATURE AND PREVENTION.

By Passed Asst. Surg. F. C. SMITH.

"*It is in the power of man to cause all parasitic (germ) diseases to disappear from the world.*"—PASTEUR.

As we learn more about diseases it is found that many of them can be prevented. Some have almost ceased to exist, as ship fever, while others, like smallpox and scurvy, have been greatly lessened. Now a great popular fight is being made against tuberculosis. It is the most important disease we have to combat, for it causes about 200,000 deaths in the United States every year and is commonest between the ages of 20 and 50, at which time people are most free from other diseases. Moreover, that is the money-earning period of life and the years of invalidism caused by tuberculosis are an important cause of poverty. It is preventable, but it can not be handled by health authorities like the quarantinable diseases, because it is too common and too chronic. Each family must be taught how to meet the danger and every person must learn how to protect himself against infection. If everyone—men, women, and children—will learn the important facts about tuberculosis and the means for its prevention, the next few years will witness a marked decrease in the disease, and the coming generation may see its way clear to complete freedom from it.

TUBERCULOSIS OF THE LUNGS (CONSUMPTION, PHTHISIS, PULMONARY TUBERCULOSIS) CAUSES MORE DEATHS THAN ANY OTHER DISEASE.

While tuberculosis is most common in middle life, it may occur at any age. When babies have it, the intestines or membranes of the brain are parts frequently attacked and death follows from peritonitis or tuberculous meningitis. Tuberculosis of the bones is common in children, and disease of the knee or hip joint or spine is usually tuberculous. It may attack any part of the body, and there is a form in which it occurs in many organs simultaneously and the patient dies of general tuberculosis. But the form in which the

disease most commonly occurs at all ages is tuberculosis of the lungs, and about nine-tenths of all the deaths from tuberculosis are due to this variety.

IT IS TRANSMITTED FROM THE SICK TO THE WELL.

Tuberculosis is a contagious disease. Every existing case contracted it by breathing in or swallowing the germs which cause it. It is probably never inherited. Children of consumptive patients often become tuberculous because they have lived in an infected house for years and have inhaled and swallowed the germs repeatedly. Parents often take the disease from their children in the same way. It is not intensely contagious, like measles and scarlet fever; it is not contracted by merely coming in contact with a consumptive, nor even by living in the house with him, if he is careful and clean. It requires an intimate exposure to the disease, such as occurs when one sleeps with a consumptive, uses the same drinking cup, dishes, or towel, or shares a living room day after day with a careless patient, who spits on the floor or coughs with uncovered mouth. Its contagiousness is perhaps less than that of typhoid fever, but tuberculosis furnishes its danger of infection for a much longer period—years instead of days. No one is so healthly or so strong that he may not at some time contract tuberculosis, although robust health is a most valuable safeguard. Probably all of us are able to withstand a few of the germs from time to time without becoming infected; they must be received at certain times when the system is weakened by fatigue, privation, or intemperance, or by other diseases, such as measles, grip, or pneumonia. But a daily exposure to the infection is almost sure to find us at some time in a condition unable to resist it. Constant attention to the details of prevention is therefore necessary if we live or work with a consumptive. Even an occasional exposure to the infection has some danger, and it is needful to protect cars, boats, waiting rooms, restaurants, and all public places from infection by careless patients.

NATURE OF THE CONTAGION—THE TUBERCLE BACILLUS OR CONSUMPTION GERM.

The germ is called the tubercle bacillus because small rounded bodies (tubercles) occurring in the diseased tissue are characteristic of the disease. The bacillus is very small and can be seen only with a high-power microscope and the aid of certain coloring matters, but once established in some organ of the body, usually the lungs, it multiplies and is produced in enormous numbers. Tubercle bacilli are given off in the sputum (phlegm, expectoration, spit) and it is

estimated that the daily sputum of the ordinary consumptive contains many millions of these germs. Every tiny speck of his sputum abounds with them and, of course, they are always present in his mouth and ordinary saliva. He leaves them on the spoon which he eats with, on the edge of his teacup or glass, and on the mouthpiece of his pipe. If he wets his finger with the tongue in turning the pages of a book he may leave tubercle bacilli on the printed sheets. If he wipes his lips with his fingers, or in coughing covers his mouth with the bare hand, then whatever he touches—food, doorknobs, another person's hand, a baby's toy—may become smeared with tubercle bacilli which find their way to the lips of some other person. If he coughs with uncovered mouth he sprays forth a multitude of fine droplets which contain tubercle bacilli in such a fine suspension of moisture that they may float in the air and be inhaled directly into the lungs by some one near him. If sputum dries upon his handkerchief or bedding anyone handling them may inhale the infected dust, which will also arise from carpet or floor which he has soiled. Flies carry his sputum on their feet from the gutter to fruit on nearby stands or to food upon the table. People carry his sputum on their shoes from the pavement into rooms where babies crawl. And whether inhaled in dust or swallowed with food, tubercle bacilli may cause tuberculosis of the lungs. It is doubtful which mode of entrance is more dangerous.

FEAR OF THE DISEASE SHOULD BE BALANCED BY A PROPER KNOWLEDGE.

All intelligent people must work to spread the important facts about tuberculosis. At present some few people do not know that the disease is contagious and disregard precautions, but far more people, having learned this fundamental fact, are merely filled with helpless terror and disgust, lacking knowledge to be helpful to others or to adequately protect themselves. We must make up our minds that we can not get away from the consumptive. There are several millions of them now living in the United States, and it is our duty to teach or force them into proper habits and at the same time protect our children and ourselves from the most common sources of infection. This can be done. The antispitting laws now existing in most cities should be backed up by a strong public sentiment. The viciously careless consumptive who daily exposes his family or neighbors to disease should be put under proper institutional control. But every possible means should be lent to make it easy for the walking consumptive to properly dispose of his sputum. Every public toilet room should be equipped with special facilities for this, and opportunities for renewing the pocket cup should be almost as fre-

quent as those provided for posting a letter in a federal mail box. There must be wise laws and public sentiment to support them, but above all a sympathetic spirit of helpfulness and cooperation.

TUBERCULOSIS HAS A LONG INCUBATION PERIOD.

If a person became sick soon after he first received the germs of this disease we would all be more keenly alive to the contagious nature of tuberculosis, but, unlike smallpox, diphtheria, or other acute infections, a very long time (incubation period) elapses before signs of the disease appear. How long this incubation period may be is not known; it is not always the same and probably varies from a few months to several years. This tends to make us careless and is another reason for the old belief in inheritance, because an infected child may become sick a year or more after the parent died of it. Besides this, the early symptoms are not characteristic; they differ widely in different people and it is almost impossible to tell just when the person first became infected.

TUBERCULOSIS IS A SLOW DISEASE—ONE DOES NOT DIE QUICKLY NOR RECOVER QUICKLY FROM IT.

Besides having a long incubation period, the disease is usually slow in progress. A man may be able to continue to do his work for a year, or for many years, after he first becomes infected. If the disease ran an acute course we would be more impressed with its contagious nature and more eager to prevent it, but one with early tuberculosis seldom feels very sick, does not look ill to his friends, and will follow his usual pursuits. He may even, under favorable circumstances, get well without ever knowing that he had tuberculosis. Very often a skillful physician after patient and careful examination makes the diagnosis of early tuberculosis; the patient after a few months presents himself to another doctor who is unable to find signs of the disease. There is nothing strange in this, for early cases are often cured by a few months' rest. It is more frequently cured than most people think and more common than was formerly believed, because only those cases which progressed to an advanced stage were called tuberculosis until a few years ago.

EARLY SYMPTOMS OF THE DISEASE NOT ALARMING.

While the symptoms of advanced tuberculosis can be recognized by almost anyone, early symptoms are not typical. Cough is not always present; sometimes a slight afternoon fever is the only symptom for months, and the patient may think he has malaria. A loss of weight and strength, rapid heartbeat, and a sense of fatigue on slight exer-

tion, loss of appetite or indigestion, with perhaps slight pains in the chest and hoarseness or cough, are the commonest symptoms of early tuberculosis. To make an early diagnosis a skillful physician will sometimes need several weeks of close observation. The family physician can best do this, with perhaps one examination by some specialist whom the family doctor calls. Never consult a doctor who advertises in the papers or in any other way. A doctor who advertises is probably a quack who cares only for money, and in tuberculosis the patient has special need to rely on the honesty of his physician. For the poor in cities there are numerous dispensaries where they can be examined free of charge by the best medical talent.

EARLY DIAGNOSIS OF THE DISEASE VERY IMPORTANT.

The importance of an early diagnosis is twofold. In the first place, proper treatment at this time will usually effect a cure, and, in the second place, the early cases are often dangerous carriers of infection. A very slight cough may be bringing up thousands of the bacilli daily. A dry cough or a sneeze may spray hundreds of infected droplets of moisture from the mouth or nose while the patient may be unaware that he is carrying infection.

TUBERCLE BACILLI WILL LIVE SEVERAL WEEKS IN SPUTUM OR IN DUST, ESPECIALLY IN DARK PLACES.

The tubercle bacillus when cast out in the sputum is not destroyed by rain or snow or by the lowest winter temperatures. In a dark room or hall it lives for months, but sunlight kills it in a few hours, and good strong daylight in a well lighted clean room will destroy it in a few days. Dirt serves as an envelope to protect the bacillus from light, and so preserves it. Dust is a vehicle to convey the germs through the air, and rooms should never be swept dry, nor should a "duster" of feathers or cloth ever be used. A consumptive's floor should be without carpets, and is best cleaned by wiping with moist cloths. A boiling temperature kills the bacillus in a few minutes, and boiling in water is one of the best ways to disinfect dishes, bedding, handkerchiefs and clothing, napkins, or towels, which the patient has used. Carpets, rugs, and clothing, which would be injured by boiling, can be rendered quite safe by being hung in the sun for a day or two, providing that all parts of the fabrics are exposed.

ANTISEPTICS OR DISINFECTANTS SPRINKLED ABOUT THE ROOM ARE USELESS.

Antiseptics are of little practical use around the house. The practice of putting chloride of lime, formalin, carbolic acid, sulphur, or any other antiseptic into sinks or in basins placed in the sick room is

useless. Germs, living in the air, in the dust on walls and carpets, or among the dirt in corners, are in no way affected by antiseptics placed in these basins. Moreover, no antiseptic solution sprinkled or mopped on floors, walls, or furniture is of any use unless all surfaces are kept soaked with it for several hours and not then unless the dirt has been previously removed to allow the fluid access to the objects. Soap and water for floors and a wet cloth with which to wipe furniture are the best agents to combat infection. A vast amount of money is spent on much advertised but worthless antiseptics. There is no antiseptic which has any practical value in the daily cleaning of a house. If the patient uses a spittoon or unburnable cup, however, 5 per cent carbolic acid or strong lye water should be placed in the container before it is given to the patient and left there all day while he uses the article. There should be enough of it to equal the amount of sputum to be disinfected.

WATERPROOF PAPER CUPS, WHICH CAN BE BURNED, ARE THE BEST SPUTUM RECEIVERS.

By far the best way to dispose of sputum is to receive it into waterproof paper cups and then to burn cup and contents together in the fire. These cups are cheap, and can be bought in any size at most drug stores; small ones can be carried in the pocket or large ones placed near the bed. Paper handkerchiefs are best to hold in front of the mouth when coughing and to wipe the lips, after which they must be burned with the sputum cup. The immediate destruction of all sputum from consumptives is the most important thing in the fight against tuberculosis, and the promiscuous spitter should be regarded with suspicion and disapproval and punished promptly and severely. Tubercle bacilli are often present in sputum during the early stages of the disease when one feels perfectly well; and even though repeated examinations of sputum have failed to reveal them, it is never safe to presume on this evidence in a case suspected of being tuberculosis, as the bacilli may be absent one day and present the next. The habitual use of a spit cup by every spitter should be compulsory. For use on the street there are several forms of pocket cups, some of which can be concealed in a handkerchief and used without being seen. But we need to cultivate everywhere a sentiment in favor of the spit cup. The person who carries one deserves respect and approval; it shows a good citizen, a law abider, and one of clean habits.

TUBERCULOSIS IS ALWAYS A SERIOUS DISEASE IN ANY STAGE.

Tuberculosis is curable, but is a very serious disease no matter how slight the symptoms may be. Sometimes it is difficult to convince patients of this, as they often feel well and do not look sick; but when

tuberculosis is diagnosed the subject should put himself unreservedly into the hands of his doctor. In no other serious disease is a sense of well-being so common or so deceptive, and until the disease has been under observation for perhaps a year it is never possible to tell how much lung tissue will be damaged or what the outcome will be.

TREATMENT: REST—AIR—FOOD.

Rest, pure air, and good food are the three essentials in treatment. Patients are no longer told to go West and rough it, because rest and good food are fully as necessary as fresh air. Rest in the open air is the ideal condition for recovery. A hammock out of doors, a bed on a porch, a mattress on the fire escape, or a pallet on a roof afford this condition. Rest means not only freedom from work, manual and mental, but the giving up of sports. A consumptive in any stage of the disease should not walk, ride, row, play ball, tennis, golf, pool, billiards, or cards, except as permitted by a physician. The laboring man or woman with a family to support is at a disadvantage, but sometimes a little extra rest will throw the balance in their favor in a fight against the disease. Strict temperance, bed as many hours as possible out of the twenty-four, and complete rest all day Sunday, with conditions favorable for open-air sleeping, will sometimes enable an early case to effect a cure while working, but all work should certainly be given up if there is any possibility of honorably avoiding it.

PATENT MEDICINES USELESS AND DANGEROUS.

There is no drug known, however rare or expensive it may be, that has any special curative action on this disease, and all remedies advertised as such are to be avoided. Patent cough medicines are harmful; radium, X rays, or electricity in any of its forms have no special value in tuberculosis of the lungs. No serum has yet been found that will cure it, and there is no plaster or poultice which has any effect on the disease itself. There are many symptoms peculiar to each case which may require medicines, but what is good for one patient may be very bad for another, and a doctor should be in charge to prescribe all medicines taken and to regulate the patient's daily life.

HOSPITALS EXCELLENT FOR TREATING ADVANCED CASES.

If it becomes evident that the disease is progressing, then the indigent consumptive should seek a hospital in his own city or town. A few weeks in bed from time to time when one is losing weight or having fever will often enable the patient to resume his work distinctly improved, and not only does a hospital offer the most favorable conditions for a cure, but by entering an institution danger of infecting members of the family is avoided. Few far advanced

consumptives are capable of observing the necessary precautions around the house without considerable help. It is their duty to protect their relatives and friends from infection and at the same time to avail themselves of medical skill and superior accommodations found in a hospital which sometimes enable the most hopeless consumptive to arrest his disease.

CHANGE OF CLIMATE RARELY NECESSARY.

The reason why some climates are better than others for tuberculosis is that rest out of doors and open-air sleeping are more pleasant in some places on account of more equable temperature and greater frequency of sunshiny days. Cold weather in itself is not an objection; in fact, it is favorable in the treatment of tuberculosis. The altitude of mountain plateaus is of doubtful advantage and no longer urged for ordinary cases. Most consumptives, rich or poor, prefer to remain near home, and they can almost always do this safely. The money which would be spent to send the patient to a distant State can often be used to much better advantage in constructing a place for open-air sleeping, in buying woolen underwear or bed comforts, and in providing milk, eggs, and other nourishing food. Most States and many cities have sanatoria or hospitals where patients may be treated, sometimes free of charge, and be near enough to their homes to see their friends frequently. An early case properly cared for will usually arrest his disease in any climate, while for a far advanced case rest, food, and nursing, which are more apt to be found near home than among strangers, are more important than a choice location.

NIGHT AIR IS GOOD FOR CONSUMPTIVES.

Sleeping out-of-doors or under conditions as nearly as possible like outdoors is very essential in the treatment of tuberculosis. No one need be afraid of night air; all outdoor air is good, whether it is sea or mountain air, city or country air, the air of pine woods, or that of the plains. In winter woolen bed slippers, heavy flannel night clothes and perhaps a soft cap may be needed, but with a little experience one can sleep warm in the coldest weather even in Northern States. If it is not possible to find a porch or balcony to sleep on, then a room with two or more windows, all of which must be wide open, should be selected. Not only at night but also by day the patient should live in the open air, either at rest, sitting or reclining, or taking light exercise as the doctor directs.

ADVICE TO THE SICK.

Keep bedroom windows open day and night and stay in bed while fever lasts.

Take no medicine except that prescribed by your doctor; spend your money for food rather than drugs.

Drink no whisky, beer, or other liquors unless prescribed by your doctor.

Eat regularly and try to get fat; a gain in weight is most favorable. Plain food is much better than dainties, milk and eggs being especially good.

Take no exercise except as ordered by your doctor.

Never run; avoid getting tired; a long walk which brings you home exhausted may spoil the gain a whole week of rest has made.

Keep your feet warm and dry.

If you are offered admission to a hospital accept at once.

Do not seek another climate except by advice of your physician and with full knowledge of the living conditions in the proposed location.

Do not spit on the sidewalk or in your handkerchief or into anything except a spit cup.

Burn all your sputum before it dries.

Never swallow what you cough up.

Do not let flies get at your spit cup.

Hold a paper napkin before the mouth when coughing and wipe the lips with it.

Have a large pocket with removable lining to keep soiled paper napkins in, or carry a paper bag for the purpose; burn them every night.

Wash face and hands several times daily and keep finger nails clean.

Do not allow your clothing or bedclothes to become soiled with sputum.

Have your own towel, soap, and drinking glass.

Scald your dishes and wash them separately.

Boil your handkerchiefs before adding them to the wash.

Sleep alone.

Wear neither beard nor mustache.

Never kiss anyone.

HOW TO AVOID CONTRACTING TUBERCULOSIS.

Keep in good physical condition all the time.

Cultivate a proper carriage of the body.

Breathe through the nose and practice deep breathing in the open air several times every day.

Bathe frequently; a cold sponge bath every morning will help ward off colds.

Sleep with windows open; spend several hours outdoors every day; and keep the room well aired where you live, work, or study.

Sleep nine hours every night, eat regularly, and be temperate in all things.

Avoid hot rooms.

Do not move into a house vacated by a consumptive until it has been well cleaned and disinfected.

Do not work in a shop or office which is dusty or poorly ventilated.

Never use a common drinking cup at a public fountain.

Report the promiscuous spitter.

Have your lungs examined once a year.

Do not put into your mouth anything taken from the mouth of another person, such as a whistle, blowpipe, marble, candy, gum, or partly eaten fruit.

Do not allow anyone to kiss you on the mouth.

Do not play on the floor of a consumptive's room.

REGULATIONS TO PREVENT THE SPREAD OF TUBERCULOSIS IN GOVERNMENT BUILDINGS, OFFICES, AND WORKSHOPS.[a]

1. All persons in Government employ are positively forbidden to spit upon the floors.

2. Rooms, hallways, corridors, and lavatories shall be freely aired and effectually cleaned at least once a day and not during working hours.

3. Spittoons shall receive a daily cleansing with very hot water and when placed ready for use must contain a small quantity of water.

4. Dust must be removed as completely as possible by means of dampened cloths or mops. It should never be needlessly stirred up by a broom or duster, as this practice only spreads the dust and germs.

5. Floors of tiling, brick, or stone must be frequently scoured with soap and water.

6. The senior clerks in charge of workrooms will take measures to secure during working hours the admission of as much fresh air and sunshine as the conditions will permit.

7. The use of individual drinking glasses is recommended.

8. Persons in government employ who suffer from pulmonary tuberculosis shall when possible be separated from others while at work.

9. Such persons will not be permitted to use the public spittoons, but must provide themselves with individual sputum receivers, preferably of easily destructible material, and carry these with them on arrival and on departure. They will be held strictly responsible for the disposal and destruction of their own sputum, so that no other person's health may be endangered therefrom.

10. Such persons must provide their own drinking glasses, soap, and towels, and shall not use those provided for the general use.

11. Plainly printed notices, reading as follows: "DO NOT SPIT ON THE FLOOR; TO DO SO MAY SPREAD DISEASE," shall be prominently posted in rooms, hallways, corridors, and lavatories of public buildings.

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[a] Prepared by the Committee on Prevention of Tuberculosis in Government buildings in accordance with Executive Order of December 7, 1905.

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CLOSED. A DEVICE INSIDE PREVENTS CONTENTS FROM SPILLING OUT IF CUP IS TIPPED OVER.

OPENED FOR CLEANING.

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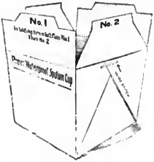
POCKET CUP CONCEALED IN HANDKERCHIEF.

HAND SPUTUM CUP WITH REMOVABLE PASTEBOARD FILLER.



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TREASURY DEPARTMENT

Public Health and Marine-Hospital Service of the United States

PUBLIC HEALTH BULLETIN No. 37

THE SANITARY PRIVY:

ITS PURPOSE AND CONSTRUCTION

BY

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PREPARED BY DIRECTION OF THE SURGEON-GENERAL

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THE SANITARY PRIVY: ITS PURPOSE AND CONSTRUCTION.[a]

By CH. WARDELL STILES, Ph. D., Professor of Zoology, Hygienic Laboratory, United States Public Health and Marine-Hospital Service.

Soil pollution.—It is common knowledge among farmers that if live stock is kept year after year in the same pasture the animals will not thrive; in fact, that sooner or later, especially during a warm, moist season, they will probably sicken and die; this is especially true as applied to young animals.

The scientific explanation of this fact is clear. Nearly all animals harbor parasites in their intestinal canal; their eggs are passed in the droppings and develop young worms which in turn reinfect the live stock. If a pasture is in constant use, the ground becomes heavily infested with the young worms and other germs; the smaller the pasture and the greater the number of animals kept in it, the more intensified is the soil pollution. A warm, moist season is especially favorable to the development of parasitic worms, hence during such seasons the infection of the stock is more severe. The more heavily the animals are infected with parasites, the greater is the strain upon the strength of the stock and the less they thrive; when the infection reaches a point at which the pastured animals suffer, they naturally become sick. In other words, the soil pollution of a field by live stock renders the pasture unfavorable for raising animals, and the farmer learns by experience that it is necessary to move his cattle and sheep to other ground in order "to give the old pasture a rest," or expressed more technically, in order to permit the young worms and other germs in the pasture to die.

The foregoing principles, so well known to farmers in respect to their horses, cattle, swine, sheep, and chickens, apply with equal force to their families, but, strange to say, farmers are not so familiar with these principles as applied to their children as they are as applied to their live stock.

The prevention of soil pollution.—The *privy* is an invention of man which enables him to use the same yard (namely, pasture) for his family, year after year, and by which he is able to protect his family from the evils of soil pollution. Human beings, as well as cattle,

[a] Pages 3–11 are reprinted from pp. 545–552, Public Health Reports, v. 25 (17), April 29, 1910.

sheep, horses, and chickens, may have germs, worms, and other parasites; if people pollute the soil, they too scatter germs and eggs of parasites on the ground; these eggs develop young worms, which in turn reinfect the family; the more intense this reinfection becomes, the less the children thrive, and finally a point is reached when the children or other members of the family sicken and die as a result of this infection.

If, however, a proper sanitary privy is provided, and if this is used consistently by all persons on the premises, it is clear that all the germs and infectious material (as typhoid bacilli) and all the eggs of the parasites are deposited in one place, from which they can be removed, so that the danger of reinfection is avoided.

Diseases spread by soil pollution.—It is especially the diseases of the intestinal and urinary systems that are spread by soil pollution, as for instance, typhoid fever, hookworm disease, eelworm infection, tapeworms, Cochin-China diarrhea, amebic dysentery, bacillary dysentery, etc. All of these diseases can be greatly reduced and almost entirely eradicated by preventing soil pollution.

The popular idea of the purpose of a privy.—To the popular mind, a privy (as indicated by its name) is a structure to which a person may retire in private when responding to the daily calls of nature. Modesty and privacy are the prime ideas in the lay mind which lead to the construction and use of a privy. In accordance with this widespread conception, the chief idea usually sought is to hide a person momentarily from view, and as a clump of bushes or a grove of trees secures such privacy, many persons avoid the privy and simply use some secluded private spot.

This popular conception of an outhouse is reflected not only in the standard, but also in some medical dictionaries. Thus, Webster's Dictionary defines a privy as "A necessary house or place; a backhouse." The National Medical Dictionary defines it as "An outhouse for convenience of defecation" Dunglison's Medical Dictionary does not even define the word.

The modern sanitary idea of the purposes of a privy.—To the sanitarian *the chief purpose of a privy is to prevent soil pollution, and thereby (by properly collecting the excreta) to prevent the spread of disease.* Modesty and privacy are, to the mind of the sanitarian, laudable objects, but infinitely secondary when compared with the great object of saving human life by preventing the spread of disease.

As substitute for the dictionary definition of a privy, I would suggest the following:

A privy is an outhouse designed, *primarily,* to prevent soil pollution and hence to prevent the spread of disease through dissemination of disease germs contained in the excreta; *secondarily,* to insure privacy and safeguard modesty to persons responding to the daily calls of nature.

The essential parts of a privy.—On basis of the definition just proposed, the privy should consist of two chief parts, namely: *First*, a receptacle for the excreta, in which they will be safeguarded against dissemination by any and all agents, as, for instance, rain, insects (as flies, etc.), chickens, swine, dogs, etc.; *secondly*, a retiring room for the people responding to nature's daily calls.

The essential problems in constructing a privy.—From the foregoing it is clear that the two great problems to be held in mind in constructing a privy are, *first*, to protect the receptacle for the excreta in such

FIG. 1.—An insanitary privy, found too frequently on our farms. Notice how the animals are spreading soil pollution.

a way that the germs can not spread; *secondly*, to construct the entire outhouse in such a way that persons will seek to use it and not (as is so common) to avoid it—in other words, not only must it ensure privacy, but it *must not be a disagreeable place in which to be private.* This latter point is especially important in warm climates, for the ordinary privy is so disagreeable in warm weather that people, especially men, very frequently avoid it. Still another point must be considered, namely, the cost of construction must be brought within the purse limits of the poor as well as of the well-to-do family.

How not to build a privy.—Figure 1 represents the privy as it should *not* be constructed. This style of outhouse is altogether too common, not only on farms, but also in villages and in suburbs of cities.

Figure 2 represents an outhouse which is much less offensive to the eye and to the sense of modesty, but scarcely less dangerous from a health point of view than the outhouse shown in figure 1.

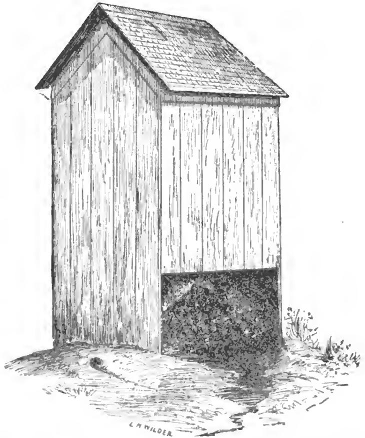

FIG. 2.—The average style of privy found in the South. It is known as a surface privy, open in back. Notice how the soil pollution is being spread, and how flies can carry the filth to the house and thus infect the food.

The fundamental fault of the structures shown in figures 1 and 2 is that both of these toilets are constructed solely on basis of the popular idea that a privy is simply a place for privacy, hence no provision exists for safeguarding against the spread of disease. It may be admitted that if outhouses of the styles shown in figures 1 and 2 are cleaned regula.ly, say once a day or once a week, the danger of the spread of disease is decreased in proportion to the care exercised in

promptly removing the excreta. But the point must be insisted upon that no matter how carefully and how frequently such toilets (figs. 1 and 2) are cleaned, *it is both theoretically and practically impossible to prevent disease from spreading* from them. For instance, flies may visit the excreta and carry infectious filth to the food, while

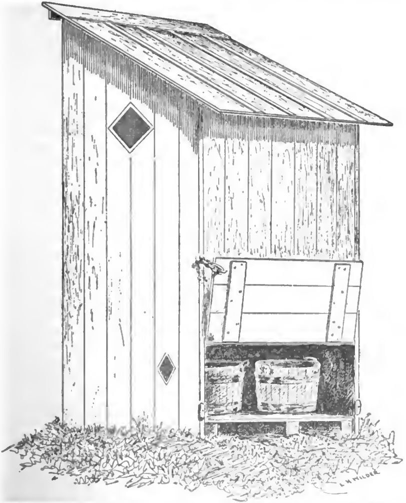

FIG. 3.—A sanitary privy, designed to prevent soil pollution. Galvanized pails may be used instead of tubs. The door should be kept closed. The ventilators should be wire-screened to keep out flies. The seats should be provided with hinged lids. It is best to use deeper tubs than are pictured here. See also figs. 5-6.

dogs, swine, and chickens may feed here and scatter infectious material over the ground. One of the common sights in villages and on farms is that of chickens feeding at outhouses constructed on the plan shown in figures 1 and 2. The public would do well to refuse to buy milk coming from farms provided with such privies.

How to build a privy.—Figures 3 and 4 show a privy designed to comply with the revised definition given above. The following are the essential features: There is (A) a closed portion (box) under the seat for the reception (in a receptacle) and safeguarding of the excreta; (B) a room for the occupant; and (C) there is proper ventilation.

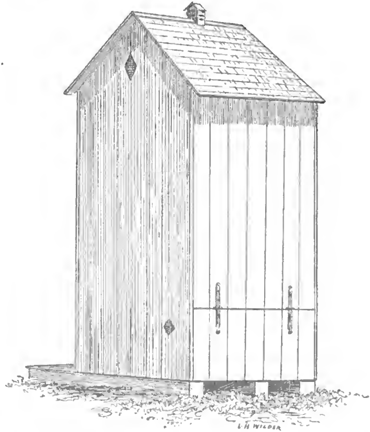

FIG. 4.—A sanitary privy showing firmly closed door, thus preventing flies, animals, etc., from having access to the fecal material.

A. The receptacle consists practically of a box, with a top represented by the *seat*, with a *floor* which is a continuation of the floor of the room, with a *front* extending from the seat to the floor, with a *hinged back* which should close tightly, and with two *sides* continuous with the sides of the room and provided with wire screened ventilators, the upper margin of which is just under the level of the seat. The seat should have one or more holes according to the size of the privy desired, and each hole should have a *hinged lid* which lifts up

toward the back of the room; there should be a piece of wood nailed across the back, on the inside of the room, so as to prevent the lids from being lifted sufficiently to fall backward and so as to make them fall forward of their own accord as soon as the person rises. In this box there should be one or more water-tight tubs, half barrels, pails, or galvanized cans, corresponding to the number of holes in the seat. This receptacle should be high enough to reach nearly to the seat, or, better still, so as to fit snugly against the seat, in order to protect the floor against soiling, and sufficiently deep to prevent splashing the person on the seat; it should be held in place by cleats nailed to the floor in such a way that the tub will always be properly centered. The back should be kept closed, as shown in figure 4.

B. The room should be water-tight and should be provided in front with a good, tightly fitting *door*. The darker this room can be made the fewer flies will enter. The *roof* may have a single slant, as shown in figure 3, or a double slant, as shown in figure 4, but while the double slant is somewhat more sightly, the single slant is less expensive on first cost. The room should be provided with two or three wire-screened ventilators, as near the roof as possible.

C. The ventilators are very important additions to the privy, as they permit a free circulation of air and thus not only reduce the odor but make the outhouse cooler. These ventilators should be copper wire screened in order to keep out flies and other insects. There should be at least 4 (better 5) ventilators, arranged as follows: One each side of the box; one each side the room near the roof; and a fifth ventilator, over the door, in front, is advisable.

Latticework, flowers, and vines.—At best, the privy is not an attractive addition to the yard. It is possible, however, to reduce its unattractiveness by surrounding it with a latticework on which are trained vines or flowers. This plan, which adds but little to the expense, renders the building much less unsightly and much more private.

Disinfectant.—It is only in comparatively recent years that the privy has been thought worthy of scientific study, and not unnaturally there is some difference of opinion at present as to the best plan to follow in regard to disinfectants.

(*a*) *Top soil.*—Some persons prefer to keep a box or a barrel of top soil, sand, or ashes in the room and to recommend that each time the privy is used the excreta be covered with a shovelful of the dirt. While this has the advantage of simplicity, it has the disadvantage of favoring carelessness, as people so commonly (in fact, as a rule) fail to cover the excreta; further, in order to have the best results, it is necessary to cover the discharges very completely; finally, at best, our knowledge as to how long certain germs and spores will live under these conditions is very unsatisfactory.

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(*b*) *Lime.*—Some persons prefer to have a box of lime in the room and to cover the excreta with this material. Against this system there is the objection that the lime is not used with sufficient frequency or liberality to keep insects away, as is shown by the fact that flies carry the lime to the house and deposit it on the food.

(*c*) *Water and oil.*—A very cheap and simple method is to pour into the tub about 2 or 3 inches of water; this plan gives the excreta a chance to ferment and liquefy so that the disease germs may be more easily destroyed. If this plan is followed a cup of oil (kerosene will answer) should be poured on the water in order to repel insects.

(*d*) *Cresol.*—Some persons favor the use of a 5 per cent. crude carbolic acid in the tub, but probably the compound solution of cresol (U. S. P.) will be found equally or more satisfactory if used in a strength of 1 part of this solution to 19 parts of water.

If a disinfectant is used the family should be warned to keep the reserve supply in a place that is not accessible to the children, otherwise accidents may result.

Cleaning the receptacle.—The frequency of cleaning the receptacle depends upon (*a*) the size of the tub, (*b*) the number of persons using the privy, and (*c*) the weather. In general, it is best to clean it about once a week in winter and twice a week in summer.

An excellent plan is to have a double set of pails or tubs for each privy. Suppose the outhouse is to be cleaned every Saturday: Then pail No. 1 is taken out (say January 1), covered, and set aside until the following Saturday; pail No. 2 is placed in the box for use; on January 8 pail No. 1 is emptied and put back in the box for use while pail No. 2 is taken out, covered, and set aside for a week (namely, until January 15); and so on throughout the year. The object of this plan is to give an extra long time for the germs to be killed by fermentation or by the action of the disinfectant before the pail is emptied.

Each time that the receptacle is emptied, it is best to sprinkle into it a layer of top soil about a quarter to half an inch deep before putting it back into the box.

Disposal of the excreta.—For the present, until certain very thorough investigations are made in regard to the length of time that the eggs of parasites and the spores of certain other germs may live under various plans (*a*) to (*d*), mentioned on pages 9–10, it is undoubtedly best to burn or boil all excreta; where this is not feasible, it is best to bury all human discharges at least 300 feet away and down hill from any water supply (as the well, spring, etc.).

Many farmers insist upon using the fresh night soil as fertilizer. In warm climates this is attended with considerable danger, and if it is so utilized, it should never be used upon any field upon which

vegetables are grown which are eaten uncooked; further, it should be promptly plowed under.

In our present lack of knowledge as to the length of time that various germs (as spores of the ameba which produce dysentery, various eggs, etc.) *may live, the use of fresh, unboiled night soil as a fertilizer is false economy which may result in loss of human life. This is especially true in warm climates.*

DIRECTIONS FOR BUILDING A SANITARY PRIVY.

In order to put the construction of a sanitary privy for the home within the carpentering abilities of boys, a practical carpenter has been requested to construct models to conform to the general ideas expressed in this article, and to furnish estimates of the amount of lumber, hardware, and wire screening required. Drawings of these models have been made during the process of construction (figs. 7, 8) and in completed condition (figs. 5, 6). The carpenter was requested to hold constantly in mind two points, namely, (1) economy and (2) simplicity of construction. It is believed that any 14-year-old schoolboy of average intelligence and mechanical ingenuity can, by following these plans, build a sanitary privy for his home at an expense for building materials, exclusive of receptacle, of $5 to $10, according to locality. It is further believed that the plans submitted cover the essential points to be considered. They can be elaborated to suit the individual taste of persons who prefer a more elegant and more expensive structure. For instance, the roof can have a double (fig. 4) instead of a single slant, and can be shingled; the sides, front, and back can be clapboarded or they can be shingled. Instead of one seat (figs. 5, 6) or six seats (figs. 9, 10), there may be two, three, four, or five seats, etc., according to necessity.

A SINGLE-SEATED PRIVY FOR THE HOME.—Nearly all privies for the home have seats for two persons (fig. 3), but a single privy can be made more economically.

Framework.—The lumber required for the framework (fig. 8) of the outhouse shown in figure 5 is as follows:

A. Two pieces of lumber (scantling) 4 feet long and 6 inches square at ends.
B. One piece of lumber (scantling) 3 feet 10 inches long; 4 inches square at ends.
C. Two pieces of lumber (scantling) 3 feet 4 inches long; 4 inches square at ends.
D. Two pieces of lumber (scantling) 7 feet 9 inches long; 2 by 4 inches at ends.
E. Two pieces of lumber (scantling) 6 feet 7 inches long; 2 by 4 inches at ends.
F. Two pieces of lumber (scantling) 6 feet 3 inches long; 2 by 4 inches at ends.
G. Two pieces of lumber (scantling) 5 feet long; 2 by 4 inches at ends.
H. One piece of lumber (scantling) 3 feet 10 inches long; 2 by 4 inches at ends.
I. Two pieces of lumber (scantling) 3 feet 4 inches long; 2 by 4 inches at ends.
J. Two pieces of lumber (scantling) 3 inches long; 2 by 4 inches at ends.
K. Two pieces of lumber (scantling) 4 feet 7 inches long; 6 inches wide by 1 inch thick. The ends of K should be trimmed after being nailed in place.
L. Two pieces of lumber (scantling) 4 feet long, 6 inches wide, and 1 inch thick.

First lay down the sills marked A and join them with the joist marked B; then nail in position the two joists marked C, with their ends 3 inches from the outer edge of A; raise the corner posts (D and F), spiking them at bottom to A and C, and joining them with L, I_2, G, and K; raise door posts E, fastening them at J, and then spike I_1 in position; H is fastened to K.

Sides.—Each side requires four boards (a) 12 inches wide by 1 inch thick and 8 feet 6 inches long; these are nailed to K, L, and A. The corner boards must be notched at G, allowing them to pass to bottom of roof; next draw a slant from front to back at G–G, on the outside of the boards, and saw the four side boards to correspond with this slant.

Back.—The back requires two boards (b) 12 inches wide by 1 inch thick and 6 feet 11 inches long, and two boards (c) 12 inches wide by 1 inch thick and 6 feet 5 inches long. The two longest boards (b) are nailed next to the sides; the shorter boards (c) are sawed in two so that one piece (c^1) measures 4 feet 6 inches, the other (c^2) 1 foot 11 inches; the longer portion (c^1) is nailed in position above the seat; the shorter portion (c^2) is later utilized in making the back door.

Floor.—The floor requires four boards (d) which (when cut to fit) measure 1 inch thick, 12 inches wide, and 3 feet 10 inches long.

Front.—The front boards may next be nailed on. The front requires (aside from the door) two boards (e) which (when cut to fit) measure 1 inch thick, 9 inches wide, and 8 feet 5 inches long; these are nailed next to the sides.

Roof.—The roof may now be finished. This requires five boards (f) measuring (when cut to fit) 1 inch thick, 12 inches wide, and 6 feet long. They are so placed that they extend 8 inches beyond the front. The joints (cracks) are to be broken (covered) by laths one-half inch thick, 3 inches broad, and 6 feet long.

Box.—The front of the box requires two boards, 1 inch thick and 3 feet 10 inches long. One of these (g) may measure 12 inches wide, the other (h) 5 inches wide. These are nailed in place, so that the back of the boards is 18 inches from the inside of the backboards. The seat of the box requires two boards, 1 inch thick, 3 feet 10 inches long; one of these (i) may measure 12 inches wide, the other (j) 7 inches wide. One must be jogged (cut out) to fit around the back corner posts (F). An oblong hole, 10 inches long and 7½ inches wide, is cut in the seat. The edge should be smoothly rounded or beveled. An extra (removable) seat for children may be made by cutting a board 1 inch thick, 15 inches wide, and 20 inches long; in this seat a hole is cut, measuring 7 inches long by 6 inches wide; the front margin of this hole should be about 3 inches from the front edge of the board; to prevent warping, a cross cleat is nailed on top near or at each end of the board.

A cover (k) to the seat should measure 1 inch thick by 15 inches wide by 20 inches long; it is cleated on top near the ends, to prevent warping; it is hinged in back to a strip 1 inch thick, 3 inches wide, and 20 inches long, which is fastened to the seat. Cleats (m) may also be nailed on the seat at the sides of the cover. On the inside of the backboard, 12 inches above the seat, there should be nailed a block (l), 2 inches thick, 6 inches long, extending forward 3½ inches; this is intended to prevent the cover from falling backward and to make it to fall down over the hole when the occupant rises.

On the floor of the box (underneath the seat) two or three cleats (n) are nailed in such a position that they will always center the tub; the position of these cleats depends upon the size of the tub.

Back door.—In making the back of the privy the two center boards (c) were sawed at the height of the bottom of the seat. The small portions (c^2) sawed off (23 inches long) are cleated (o) together so as to form a back door which is hinged above; a bolt or a button is arranged to keep the door closed.

Front door.—The front door is made by cleating (p) together three boards (q) 1 inch thick, 10 inches wide, and (when finished) 6 feet 7 inches long; it is best to use three cross cleats (p) (1 inch thick, 6 inches wide, 30 inches long), which are placed on the inside. The door is hung with two hinges (6-inch "strap" hinges will do), which are placed on the right as one faces the privy, so that the door opens from the left. The door should close with a coil spring (cost about 10 cents) or with a rope and weight, and may fasten on the inside with a catch or a cord. Under the door a crosspiece (r) 1 inch thick, 4 inches wide, 30 inches long (when finished) may be nailed to the joist. Stops (s) may be placed inside the door as shown in figure 5. These should be 1 inch thick, 3 inches wide, and 6 feet 6 inches long, and should be jogged (cut out) (t) to fit the cross cleats (p) on the door. Close over the top of the door place a strip (v) 1 inch thick, 2 inches wide, 30 inches long, nailed to I (fig. 7). A corresponding piece (v) is placed higher up directly under the roof, nailed to G. A strap or door pull is fastened to the outside of the door.

Ventilators.—There should be five ventilators (w). One is placed at each side of the box, directly under the seat; it measures 6 to 8 inches square. Another (12 inches square) is placed near the top on each side of the privy. A fifth (30 inches long, 8½ inches wide) is placed over the door, between G and I_1 (figs. 5, 7). The ventilators are made of 15-mesh copper wire, which is first tacked in place and then protected at the edge with the same kind of lath that is used on the cracks and joints.

Lath.—Outside cracks (joints) are covered with lath one-half inch thick by 3 inches wide.

Receptacle.—For a receptacle, saw a water-tight barrel to fit snugly under the seat; or purchase a can or tub, as deep (17 inches) as the distance from the under surface of the seat to the floor. If it is not possible to obtain a tub, barrel, or can of the desired size, the receptacle used should be elevated from the floor by blocks or boards so that it fits snugly under the seat. A galvanized can measuring 16 inches deep and 16 inches in diameter can be purchased for about $1, or even less. An empty candy bucket can be purchased for about 10 cents.

Order for material.—The carpenter has made out the following order for lumber (pine, No. 1 grade) and hardware to be used in building a privy such as is shown in figure 5:

1 piece scantling, 6 by 6 inches by 8 feet long, 24 square feet.
1 piece scantling, 4 by 4 inches by 12 feet long, 16 square feet.
5 pieces scantling, 2 by 4 inches by 16 feet long, 54 square feet.
3 pieces board, 1 by 6 inches by 16 feet long, 24 square feet.
2 pieces board, 1 by 9 inches by 9 feet long, 14 square feet.
3 pieces board, 1 by 10 inches by 7 feet long, 18 square feet.
15 pieces board, 1 by 12 inches by 12 feet long, 180 square feet.
12 pieces board, ½ by 3 inches by 16 feet long, 48 square feet.
2 pounds of 20-penny spikes.
6 pounds of 10-penny nails.
2 pounds of 6-penny nails.
7 feet screen, 15-mesh, copper, 12 inches wide.
4 hinges, 6-inch "strap," for front and back doors.
2 hinges, 6-inch "T," or 3-inch "butts," for cover.
1 coil spring for front door.

According to the carpenter's estimate, these materials will cost from $5 to $10, according to locality.

There is some variation in the size of lumber, as the pieces are not absolutely uniform. The sizes given in the lumber order represent the standard sizes which should be ordered, but the purchaser need not expect to find that the pieces delivered correspond with mathematical exactness to the sizes called for. On this account the pieces must be measured and cut to measure as they are put together.

ESTIMATE OF MATERIAL FOR SCHOOL PRIVY.

The following estimate of building materials has been made, by a carpenter, for the construction of a six-seated school privy, such as is shown in figures 9 to 11. The estimated cost of these materials is $25 to $50, according to locality; this does not include the pails, which ought not to cost over $1 a piece:

3 pieces scantling, 6 by 6 inches by 20 feet, 180 square feet.
1 piece scantling, 6 by 6 inches by 8 feet, 24 square feet.
Scantling, 2 by 4 inches, 165 square feet.
Boards, 1 by 12 inches, 600 square feet.
Boards, 1 by 10 inches, 185 square feet.

Boards, 1 by 8 inches, 100 square feet.
Boards, 1 by 6 inches, 80 square feet.
Boards, ½ by 3 inches, 100 square feet.
Flooring, 80 square feet.
40 feet 15-mesh copper wire screen, 12 inches wide.
12 pairs of hinges, 6-inch "strap."
6 pairs of hinges, 6-inch "T."
3 pounds of 20-penny spikes.
15 pounds of 10-penny nails.
8 pounds of 6-penny nails.
6 coil springs for front doors.
6 knobs or latches.

A COMPULSORY SANITARY PRIVY LAW—PRIVY LICENSE.

A compulsory sanitary privy law or ordinance should exist and be strictly enforced in all localities in which connection with a sewer system is not enforced.

Since, from a sanitary point of view, the privy is a public structure, in that it influences public health, it seems wisest to have city and town ordinances which provide for a licensing of all privies, the license being fixed at a sum which will enable the city or town to provide the receptacle (tub, pail, etc.), the disinfectant, and the service for cleaning. The expense involved will vary according to local conditions, such as cost of labor and density of population. If the "chain gang" can be utilized for cleaning, the expense for labor is reduced.

The importance of taking the responsibility for the care of the privy out of the hands of the family is evident when one considers that one careless family in ten or in a hundred might be a menace to all. Quite generally the removal of garbage and of ashes is recognized as a function of the city or town in all better organized communities, and the idea is constantly spreading that this service should extend to a removal of the night soil also.

In correspondence with certain cotton mills estimates for privy cleaning (once a week) vary from about 20 to 25 cents per privy per month. A privy tax of \$3.50 to \$5 per privy per year ought to give satisfactory service, including receptacle, but the exact amount of the tax must be determined by experience in each locality.

It is probably the exception that an economical public privy-cleaning service can be carried out in the open country, on account of the distances between the houses. To meet the difficulties involved, several suggestions may be considered, according to conditions: A county privy tax can be levied, the county can furnish the pail and the disinfectant, and (1) one member of each family or of several neighboring families hired to clean the privy regularly; or (2) the landlord can be held responsible for the cleaning of all privies of his tenants, receiving from the county a certain sum for

the service; or (3) "trusties" from prisons might possibly be utilized in some districts not too sparsely settled; or (4) a portion of the county privy tax might perhaps be apportioned by school districts and be distributed as prizes among the school boys who keep their family privy in best condition; or (5) each head of family might be held responsible for any soil pollution that may occur on his premises and be fined therefor.

Undoubtedly the problem of the privy cleaning in the open country is much more difficult than in cities, villages, and towns, and in the last instance involves a general education of the rising generation of school children, more particularly of the girls (the future housekeepers), in respect to the dangers of soil pollution.

FIG. 5.—A single-seated sanitary privy. Front view.

FIG. 6.—The same. Rear and side view.

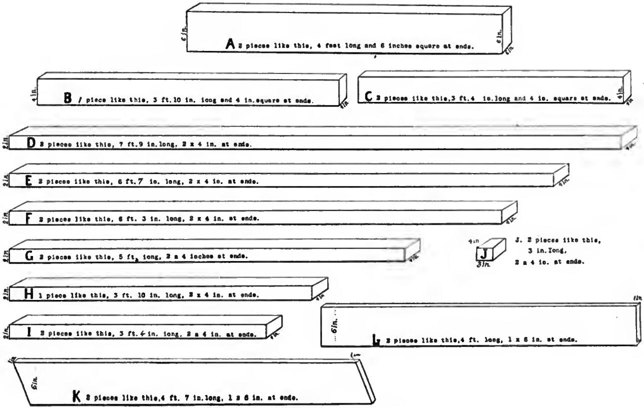

Fig. 7.—The scantling necessary for a single-seated privy. (Fig. 5.)

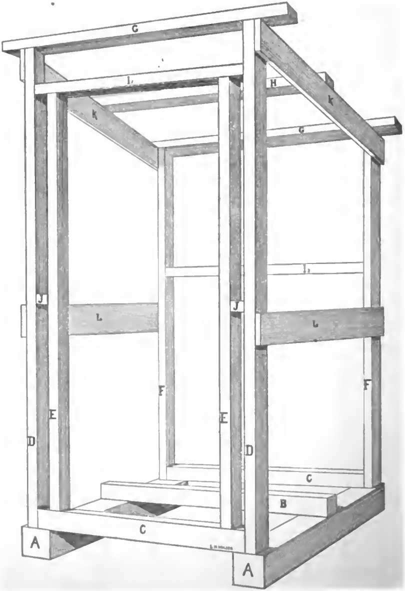

FIG. 8.—The framework (assembled) for same.

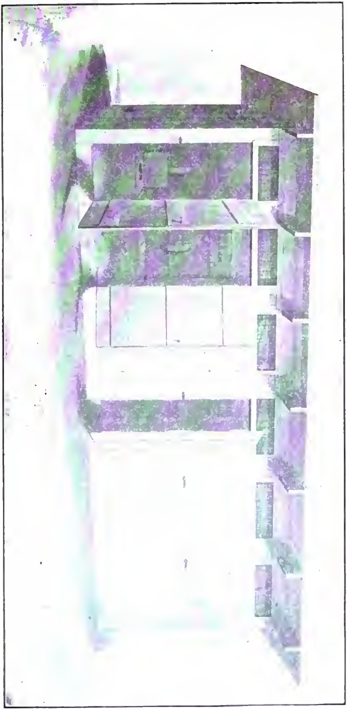

FIG. 9.—A 6-seated sanitary privy, for hotels and schools. Front view.

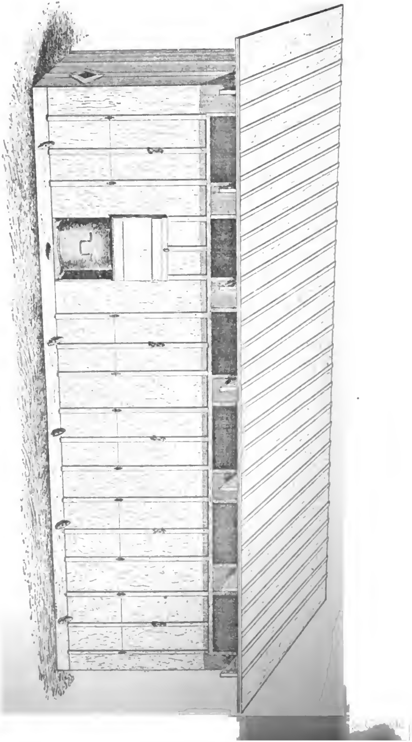

FIG. 10.—Rear view of same.

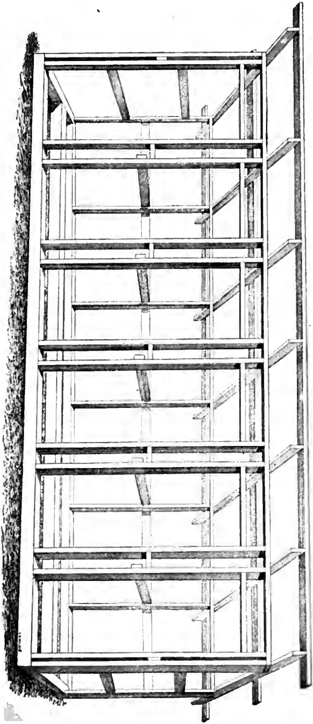

FIG. 11.—The framework (assembled) for same.

GENERAL OBSERVATIONS ON THE BIONOMICS OF THE RODENT AND HUMAN FLEAS.

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It is desired in this paper to convey an insight into the habits and metamorphoses of the California species of fleas commonly found on rats, ground squirrels, and man. Numerous requests from medical officers for information of this nature are regarded as sufficient justification for the compilation of these notes. The paper is preliminary in character, as the studies are still in progress.

THE MATERIALS USED FOR FLEA DEVELOPMENT.

We have made an effort to rear fleas in the laboratory by attempting to duplicate conditions found to exist in nature. The human flea, *Pulex irritans* Linn., was found to develop very satisfactorily in a medium composed of floor sweepings taken from cracks in the floor. The squirrel fleas and rat fleas were found to develop well in material taken from the nests of their respective hosts. We have experienced no difficulty in raising these parasites by placing animals covered with fleas in cages with a bedding of sawdust; and the only provision necessary for complete development was the addition of fresh sawdust to prevent the accumulation of too much moisture.

An experiment was made to determine in what nesting material fleas away from the host would survive longest. For this purpose we tested various materials shown in the following table:

Length of life in various nesting materials.

CERATOPHYLLUS ACUTUS BAKER.

[M=male; F=female.]

Removed from host.	Dry sand with squirrel droppings.	Moist sand from squirrel nest.	Dry sand from squirrel nest.	Sawdust moistened with horse serum.	Dry sawdust.	Moistened sawdust with wheat grains.
2 days	5 M.; 5 F.	10 F.	10 F.	4 M.; 6 F.	4 M.; 6 F.	4 M.; 6 F.
7 days	2 M.; 5 F.	4 F.	All dead.	1 M.; 3 F.	4 F.	1 M.; 5 F.
9 days		1 F.		2 F.	2 F.	1 M.; 4 F.
10 days	2 M.; 5 F.	All dead.		All dead.	All dead.	1 M; 4 F.
14 days	1 M.; 1 F.					1 M.; 3 F.
16 days	1 M.; 1 F.					
17 days	All dead.					1 M; 3 F.
20 days						3 F.
25 days						1 F.
26 days						All dead.

The controls, 5 males, 5 females, were all dead on or before the seventh day.

In the medium of moistened sawdust mixed with a few wheat grains it was found that the wheat sprouted in the sawdust and held sufficient moisture to provide a suitable condition for larvæ as well as for adults. The mould which formed in a short time did not seem to affect the insect life.

It is seen that the fleas did not fare well in the medium of dry sand. The sand was mixed with clay dust, which would rise whenever the fleas hopped in the vial. As a consequence death resulted, presumably by stoppage of the spiracles.

It will be seen from a survey of this table that fleas taken from the natural host may be kept alive without food for a considerable time. The medium of moistened sawdust with a few grains of wheat seemed to answer the moisture requirements for flea life.

This material was used to determine the longevity of squirrel fleas reared from cocoons in the laboratory. The adults had emerged October 4, 1909, and were transferred on the same day to an open museum jar, supplied with a layer of sawdust and moistened wheat grains. Twenty specimens, 8 males and 12 females, were used in this experiment. On the twenty-eighth day 1 male and 8 females were alive. The male survived until the thirty-eighth day, when only a single female remained. This female lived until January 25, 1910, a period of eighty-one days from the time of emergence.

The virility of these fleas was shown when a male and a female were applied to the hand of the experimentor and fed on the twenty-seventh day. The two fed fleas were excluded from the experiment after the feeding.

LOCOMOTION.

The only literature that has come to our notice on the jumping powers of fleas appears in the "Reports of the advisory committee on plague investigations in India" (Journal of Hygiene, 1906, vol. 6, p. 464). Here we have a note: "It had previously been found that a rat flea could not hop farther than 5 inches." The species in question in these experiments was the *Læmopsylla cheopis* Roth, which constitutes 99 per cent of the fleas found on rats in India.

It seemed desirable to learn the jumping abilities of the common California species. An attempt was made to determine the distance upon a horizontal plane, as well as the height that the insect could jump. In the broad jump a few experiments were conducted with *P. irritans*, the most active of our California fleas. In this species we have found the jumping distance varies considerably with the nature of the container from which the insect is observed, eg., a foot-

hold of wood enables the flea to jump a greater distance than one of glass. Since the *irritans* is found to predominate on floors of houses, a surface of wood was selected as the footing in our tests. In one experiment five specimens were permitted to jump at will and the jumps of each were recorded. The mean average of ten jumps of each specimen gave a distance of 7.3 inches. The longest jump recorded was 11 inches; this was made by a female. In another experiment a female, which was starved for five days prior to the test, made four jumps, respectively, 10.5, 11, 12, and 13 inches, averaging $11\frac{5}{8}$ inches. Thirteen inches was the longest jump recorded on a horizontal plane. A jump of $15\frac{3}{8}$ inches was made downward at an angle of 30 degrees.

This last specimen was then permitted to feed fifteen minutes on the arm of an attendant, after which it was carefully returned to the container and its jumps for five minutes recorded. The longest jump after feeding was 12 inches.

The jumping powers of squirrel and rat fleas were tested in this manner: Three hundred and seventy-five live squirrel fleas (*Ceratophyllus acutus*) and 150 live rat fleas (*C. fasciatus* Bosc. and *L. cheopis*) were segregated into species and placed in 15 open specimen vials in a water bath and left undisturbed for two days. At the end of the period the vials were examined, the water bath and the surroundings being carefully inspected. No fleas could be detected in the water bath or in the vicinity. The fleas in the vials were counted, the original number being present. They were apparently as active as when removed from their hosts. The containers were cylindrical vials $3\frac{3}{8}$ inches in height and $1\frac{3}{16}$ inches in diameter. The same test was tried in open shell vials of the next size smaller ($3\frac{1}{8}$ by 1 inch), and the fleas were found jumping into the water bath.

L. cheopis, the rat flea, was tried for its jumping powers. It had been previously observed that members of this species were unable to leap out of open shell vials $3\frac{3}{8}$ inches in height. It was thought desirable to permit the flea greater latitude, making the trial fairer and more practical. Twenty fleas (8 males and 12 females) were placed in a rectangular porcelain dish, the dimensions of which were $11\frac{3}{4}$ inches by $7\frac{5}{8}$ inches by $2\frac{1}{4}$ inches deep. A light sprinkling of moist sand was placed in the bottom of the dish to provide a firm footing and the sides of the dish were extended to the height of $4\frac{1}{2}$ inches by inclosing the container entirely by strips of "tangle-foot" paper. At the end of twenty-four hours the dish with the fleas was examined and it was observed that several fleas had leaped high enough to become entangled in the adhesive paper. The position of these was noted; the distance from the bottom of the pan was

measured. The entangled insects were pried off, the sticky material dissolved with alcohol, and the insects examined microscopically. Five specimens were collected, two males and three females. The locations on the adhesive paper relative to the base of the dish were as follows: One female $2\frac{1}{2}$ inches, 1 female $3\frac{1}{8}$ inches, 1 female $2\frac{9}{16}$ inches; 1 male $2\frac{5}{8}$ inches, 1 male $3\frac{1}{16}$ inches.

A census of the fleas remaining in the bottom of the dish gave 6 males and 9 females, showing that none jumped over the surrounding paper, and that all jumping over $2\frac{1}{2}$ inches were embedded in the adhesive paper.

The jumping powers of *P. irritans* were further tested, 20 fleas of this species being placed in a rectangular museum jar, the inside dimensions of which were $2\frac{1}{4}$ by $5\frac{1}{2}$ by $7\frac{3}{4}$ inches deep. The glass lid of the jar was coated with "tangle foot" and the upper 2 inches of the jar were coated with the same material. The following morning the jar was examined and two specimens were seen embedded in the "tangle foot" on the lid. The inside height of the jar being $7\frac{3}{4}$ inches from the base gives then this height as the perpendicular jump.

Concerning the flea's ability to walk upward on glass, we have noted that they can not climb to any considerable distance. Approximately 100 counts were taken, the greatest distance observed being three-quarter inches. The climb appears very laborious, and in all cases the flea dropped to the bottom of the jar after a few efforts.

The style in which rodent fleas walk through the pelage of the host is worthy of comment. They seem to shuffle along on the flat side of the tarsi, parting the dense hairs into furrows which close over the active insect with a wavy motion. When on the animal they seldom hop about, unless disturbed or unless the host snaps at them or scratches when unusually annoyed. They hop freely when jumping from the animal to the ground or vice versa, or from one host to another. When a flea is cornered; that is, when it experiences difficulty in passing an obstruction, it proceeds like a swimmer using the side stroke. The parasite drops to its side and locomotion ensues by a vigorous sweeping movement of the legs, almost entirely by the use of the hairs and spines, especially through the medium of the powerful spines of the tibia effecting a progressive movement while it ambles along on the flat side in a striking manner. The spines of the leg seem to be peculiarly adapted for this side motion. It is in this fashion that the nimble parasite manages to become so very elusive. We refer especially to the *P. irritans*. This may be tested by holding a live flea between the thumb and forefinger, and unless you chance to be a flea trapper of long and painful experience the ingenious parasite will surely escape.

CONSIDERATION OF COLOR ATTRACTION.

A little experimental evidence has been obtained on the question of attraction toward color in animals. It is the prevailing opinion that white animals attract the greatest number of fleas. A few tests of color attraction are cited here. The material used in the first experiment was six guinea pigs showing extreme variations of color. Three of these were pure white in color and three were dark brown and black. These were placed in a large cage, the bedding of which was infested with squirrel fleas. After forty-eight hours the guinea pigs were removed simultaneously and a census of the fleas on the individual animals was made immediately. Fleas and animals were anæsthetized at the same time, the white guinea pigs yielding, respectively, 10 fleas, 5 fleas, and 11 fleas. The black guinea pigs yielded 11, 7, and 4 fleas; the last number came from a mixed black and white guinea pig. A summary of the fleas from the three white guinea pigs gave 26 fleas, or an average of about 9 each; the two dark guinea pigs giving 18, averaging 9 each; and the black and white giving 4 fleas, all of which were of the species *C. acutus*, the common squirrel flea.

A second experiment was as follows: Four guinea pigs were placed in a large container which was swarming with squirrel fleas. After three days the animals were removed as before, and a census of the parasites was taken; one brown and black guinea pig yielded 89 fleas; another brown and black guinea pig yielded 57 fleas; a pure white guinea pig yielded 57 fleas; and the other white guinea pig yielded 60 fleas. These guinea pigs were kept together in the open vessel under the same conditions of light and temperature.

One experiment was conducted by using guinea pigs as traps for fleas in an infested house. The results shown are relatively meager, due to the previous use of adhesive paper for flea trapping. In this test six guinea pigs were permitted to wander for twenty-four hours through the basement of the house. The fleas collected from the guinea pigs were *P. irritans*, found on the hosts as follows:

Color of animal.	Number of fleas.
Black guinea pig	1
White guinea pig	1
Black guinea pig	1
White guinea pig	1
Black guinea pig	0
White guinea pig	0

It is obvious from the meager evidence presented in these experiments that color does not exert the influence generally claimed for it.

The white animals are no more attractive to the fleas we have used than are the dark-colored ones.

TRAPPING OF FLEAS WITH MEAT AS A BAIT.

An idea prevails that fleas can be attracted and trapped on account of their predilection for the odor of fresh meat. This idea was put to test in an experimental way. On the 23d day of August, 1909, during a season of the year in which fleas were extremely abundant, a vacant house, which was found to be flea infested, was chosen for the experiment. The fleas were so abundant that when two attendants, who had occasion to enter the first floor of the dwelling, remained for a period of five minutes and emerged covered with fleas, approximately 200 fleas were taken from their clothing and persons. The materials used for the experiment were 12 sheets of "tangle-foot" fly paper, distributed in pairs among three rooms of the house. One sheet of each pair was supplied with a small fresh piece of cow's liver. Care was taken to distribute the sheets in such a manner that the influence of light would be the same for each pair of sheets in the series. The sticky fly papers were left undisturbed for a period of three days, then collected and examined.

A similar experiment was conducted at a later date, December 5, 1909, when San Francisco dwellings were still flea infested. The sheets of fly paper were left in the basement of a house for twenty-four hours. The fleas in both experiments were removed by dissolving the "tangle-foot" in alcohol. The parasites, which were identified as *Pulex irritans*, were distributed on the sheets as follows:

Total number of fleas trapped.

Pair.	Experiment 1.		Experiment 2.	
	Adhesive paper with meat.	Adhesive paper without meat.	Adhesive paper with meat.	Adhesive paper without meat.
1	0	0	2	4
2	2	2	1	3
3	2	1	6	4
4	0	3	47	49
5	6	12	1	0
6	4	1	4	1
Total	14	19	61	61

The table shows that according to our experience, though the data are limited, meat used as a bait under the conditions stated does not exert any attraction for fleas.

A third experiment of the same character as the two foregoing was conducted in a house which was infested with both *P. irritans*

and *Ctenocephalus canis* Curtis. The results show that the count for each species was relatively about the same.

Pairs.	Experiment 3.			
	Adhesive paper with meat.		Adhesive paper without meat.	
	Pulex irritans.	Ct. canis.	Pulex irritans.	Ct. canis.
1	82	23	122	58
2	5	1	6	0
3	98	39	90	42
4	42	12	39	14
5	123	64	120	79
6	49	10	60	14
Total	399	149	437	207

In all of the foregoing "tangle-foot" trap experiments, although care was taken to place the meat on the edges as well as on the middle of the sticky paper, only one flea (*Ct. canis*) was found on the meat used as a bait.

EGG LAYING.

Mammalian blood appears essential to fleas for the performance of the normal functions of copulation and oviposition. In our experience insects kept constantly in jars and reared from cocoons, never having been fed upon a host, have not been observed to copulate or oviposit. In 30 specimens of *P. irritans* taken from a house which had been vacant for six weeks we found, after three days' observation, that the fleas were perfectly healthy, and although females predominated, no eggs were found at the end of this period. As a control, 6 females of this species collected from human hosts when kept in separate vials laid eggs normally, depositing from 5 to 12 in each instance.

Four experiments with *C. acutus*, the squirrel flea, have given results similar to the foregoing, namely, that this species when reared from cocoons and kept starved in jars at room temperature has not been observed to mate or lay eggs.

In 25 paired specimens of several species kept under observation it appears that the male does not long survive the act of mating. It dies even before the female has laid its first batch of eggs.

When fertile females are kept under artificial conditions the eggs are laid in one laying in a period beginning two hours after copulation and extending to a maximum of thirty-six hours. When deprived of food the female has never been observed to oviposit after this length of time.

We may here note that when used experimentally the female is invariably longer lived. Experiments to determine the length of life with human blood diet show that female fleas of all species outlive the male by several weeks. This is doubtless true also under natural conditions, where we find in collecting fleas from the host that the females predominate markedly.

The eggs require optimum conditions of temperature and moisture for hatching. They have never been found on the host except in one instance. In this case a dog was used in the laboratory for supplying fresh fleas; this was done by placing the canine on sheets of paper which in a few hours were littered with a large number of flea eggs. These were laid loosely on the host by the fleas, the eggs falling to the paper, where they were collected. Flea eggs have never been found on man and, if present, would not hatch under normal conditions of the body temperature. We have found that keeping eggs in the incubator at blood heat is sufficient to prevent hatching. If the eggs were laid on the host we would certainly expect to find them on the squirrel, on which animal fleas are most abundant. We have taken from two squirrels (in nature), respectively, 225 *C. acutus* and 376 of the same species; but in no instance even where fleas are present in such large numbers have we been able to find eggs even after carefully combing the host. The *C. acutus* is by all means the best criterion in this matter, since we have found that it lays more eggs than any other of the rodent fleas.

The eggs are laid singly, often appearing in small clusters. They may be viscous as in *P. irritans, C. fasciatus, L. cheopis, C. acutus;* or dry as in *Ct. canis* and *Cten. musculi.* The former adhere to the medium in which they are laid, and the eggs of the last two species are laid loosely, so that they roll about when the vial containing them is shaken.

Eggs may be laid while the insect is still under the influence of an anesthetic, when covered by a glass slip, and when exposed to strong sunlight. It appears to be the first impulse for the female to lay its eggs when removed from the host and placed under artificial conditions. The great majority of the eggs obtained were laid on the first day, beginning almost immediately after the fleas were captured. It is a common observation that many females with their abdomens distended lay their eggs as soon as the vial is closed over them. The number of eggs laid at one laying by different species varies from 3 to 18, the rat fleas averaging 6 and the squirrel fleas lay as many as 18.

THE PROCESS OF HATCHING.

C. ACUTUS.

Six eggs laid while the females were kept under observation were examined from time to time until hatched seven to nine days later.

One egg was observed microscopically during the entire process; the other five eggs used as controls were examined occasionally.

On the seventh day of incubation at room temperature the premonitory signs of hatching were discerned in a very faint rising and falling of the exochorion (outer shell layer) on one side of the shell. During the night, seven hours later, the movement grew more extensive, the pulsations becoming quite pronounced, causing the egg to shift slightly from its position. On the morning of the eighth day a deep gash was observed in the side of the egg. The gash is made by the egg opener, a wedge-shaped, horny, claw-like structure on the dorsal side back of the head of the embryo. This is operated so as to hew through the resistant shell by a series of slits or gashes. The initial gash increases slowly in length, encircling the egg within an hour.

In the course of a few hours seven successive gashes are made. The location of these is quite constant—two on each side of the egg and three at the center, the middle of the central ones being the most distinct. The young embryo produces these slits through the chorion (inner skin of the shell) by turning with its dorsal side against the shell, striking with the egg pick, first against the base of the egg, rising on its hind prolegs and striking rapidly as it climbs upward. Prior to each stroke the egg pick is poised deliberately, the weight of the head accelerating the blow; this is augmented occasionally by a lateral shaking of the head.

When the last slit encircles the shell the embryo is at the most active stage; it effects a complete rotation in its shell at intervals of ten minutes. The gashes make the shell appear as though cut into ribbons. The rotary movement gradually subsides until a complete turning consumes twenty minutes, and almost imperceptibly there follows a lull. An inactive condition prevails for a period of about seventeen hours. After the resting period it appears that the egg pick is no longer functional; no new gashes are made, the embyro seeming contented to concentrate its energies against the middle gash. This is enlarged by a puffing and dilating of the head; through the semitransparent shell is seen a constant bubbling and a subsequent dilatation of the cuticle.

On the third day of the hatching process a strong movement of the embryo gives decided evidence of the progress of hatching. Immediately beyond the egg pick a triangular slit appears through which bubbles emerge to the surface of the exochorion; thus the amnion (the embryonic cuticle) makes its initial appearance through a crack in the exochorion of the shell.

The amnion splits longitudinally, adhering to the chorion and bulging out as the insect struggles. It is pushed out of the chorion as the abdominal segments are projecting. The emergence is fur-

thered by the young larva pressing the head against its tail, causing the middle of its body to bulge through the central gap of the shell. The amnion becomes noticeably darker as it is exposed to the air; it is now a light brownish-yellow.

The pressure of the body against the shell forms nearly a round hole through which the larva eventually emerges. The opening is enlarged by pressure of the head against the tail, raising the body like a hoop, causing an arch or a hump to appear with dorsal side outward.

The amnion sheds slowly on either side from the middle of the arched abdomen ventrally and with a movement of fluid beneath, it cracks across the abdomen, peeling and wrinkling as the segments telescope. With a final vigorous bubbling and wrinkling the amnion sheds off, the moulted skin falling on either side, exposing the quiet colorless cuticle of the young insect, roughly wrinkled and bristling with slender hairs or setæ. These hairs which at first appear transparent turn grayish when exposed to the air.

When the tail of the larva has been torn loose from the shell, the head and thorax are still imprisoned within the egg, necessitating a maneuvering by waiving its tail in the air, twisting and squirming while standing on its head. The abdomen doubles up ventrally and finally the young larva supported on its tail extricates the head by a violent shaking. When the head is torn from its fastenings, it is found that the amnion has been holding it within the shell. The adhering membrane is cast out when the shell is shaken off. The larva has now fully emerged, the colorless cuticle has turned grayish and the slender threadlike bristles have assumed an irridescent hue.

INFLUENCE OF TEMPERATURE ON EGG DEVELOPMENT.

In a series of experiments in which fleas, *L. cheopis*, were subjected to various temperatures, namely, room temperature (75°–80° F.), hot room temperature (88°–90° F.), and cold room temperature (72° F.), the advisory committee on plague investigations in India concluded that there was an optimum temperature at which breeding took place more vigorously than at other temperatures; that a high mean temperature affected the breeding of fleas in restraining the imago from depositing eggs and inhibiting the development of the eggs into larvæ. (Journal of Hygiene, 1908, vol. 8, No. 2, p. 243–244.)

We have repeated in a small way the experiments with the species used by the advisory committee in addition to a few other species.

L. CHEOPIS.

In this experiment, 18 eggs of *L. cheopis* were used to determine the influence temperature exerts on the hatching process. These eggs were laid within a few hours of each other by four females which

were kept with as many males in a glass vial. The eggs were removed within one hour and divided into lots of six.

One lot of six was placed in the cold room, kept slightly below outdoor temperature. One lot was maintained at room temperature in the laboratory. The third lot was kept at the temperature of the incubator. The three lots were placed in glass cell slides, protected with cover slips, and observed at intervals without subjecting them to a change in temperature.

A. Eggs kept at high temperature.—These eggs were placed in the incubator which was regulated at a uniform temperature with a minimum range of 35° C. and a maximum of 37° C. On the third day one egg hatched and the larva almost immediately shriveled and died from the heat. In fact it succumbed in the act of emerging when all parts but the tail were freed.

Not one of the eggs remaining showed evidence of hatching when examined at this time. On the fourth day, there was no evidence of life in the other eggs. They appeared shriveled and dessicated.

B. Eggs kept at room temperature.—These eggs were kept in a covered glass cell on a table in the laboratory. The cell slide was covered so as to be protected from the light. The temperature recorded during the hatching period was 17° C. minimum and 23° C. maximum.

On August 22, the seventh day after being laid, three eggs of this lot had hatched normally. The other three eggs were observed to manifest signs of the final stage of hatching.

August 23. One egg hatched on this day.

August 25. One of the remaining eggs hatched. This last larva appeared smaller at birth than the others. The embryo in the last egg died during the process of hatching.

C. Eggs kept at low temperature.—The eggs of this batch were kept in a cell slide as in the other experiments, protected from the light. The temperature controlled was slightly below outdoor temperature of 10° C. to a maximum of 20.7° C. The eggs were examined twice daily up to the thirteenth day after being laid. During this period not one of the eggs showed signs of life.

On the thirteenth day four of the eggs showed signs of hatching, two especially indicating an advanced condition. The exochorions of these two were split in several places and the form of the larva could be discerned through the semitransparent shell.

On the next day the other two eggs indicated definite signs of hatching. The two eggs which appeared as prospective larvæ on the previous day were wholly inactive and apparently dead. The two remaining eggs on this day were hopelessly shriveled beyond development.

On the fifteenth day, only one egg of the lot evinced life signs and that feebly. All of the others had collapsed and succumbed to the unfavorable environment.

In another experiment, 80 eggs of this species laid by 25 females were divided into two lots of 40 eggs each. One lot was subjected to room temperature while the other lot was placed in the basement. The temperature here was 10° C. to 15° C. Nine to thirteen days later 28 of the eggs at room temperature (18° C. to 21° C.) had hatched while the eggs at low temperature did not hatch till the nineteenth day when 22 developed into larvæ.

C. ACUTUS.

We have learned that squirrel fleas, *C. acutus*, lay eggs and produce larvæ in every season of the year. We attempted to find in what manner the extremes of temperature would influence oviposition and hatching. Two sets of experiments were conducted; one to determine the number of eggs laid and the other to determine the percentage of eggs hatched and healthy larvæ produced. Ten fertile females were placed in each of six glass beakers. Three of these vessels were provided with moistened sawdust and bran and the other three contained only the fleas; so that the eggs could be observed readily during the hatching.

Two beakers of each set were placed in the incubator, two in the refrigerator, and two kept at room temperature.

Fate of the females and eggs at different temperatures.

Temperature.	Fleas in moist sawdust and bran.	Fleas in dry beakers.
Refrigerator fleas, 5°-8° C....	Dead in twenty-nine days; no larvæ produced.	Dead in fourteen days; 6 eggs laid; none hatched.
Incubator fleas, 34°-38° C....	Dead in three days; no larvæ produced.	Dead in two days; 22 eggs laid; none hatched.
Living room temperature fleas, 15° 22° C.	Dead in thirty-six days; 68 larvæ produced.	Dead in twenty-three days; 103 eggs laid; 50 hatched.

PULEX IRRITANS.

Five of 15 eggs kept at a temperature of 11° to 15° C. hatched in fifteen to seventeen days. The same number of eggs kept as a control at room temperature hatched in seven days. Eight of the latter proved fertile.

In another experiment of a similar character 32 eggs were subjected to a temperature of 11° to 15° C. and an equal number of eggs were used as a control at room temperature. Of the eggs kept at the low temperature, 12 hatched in fourteen days, while of those kept at room temperature, 11 hatched in seven to nine days.

OBSERVATIONS ON LARVAL LIFE.

The larvæ upon hatching busy themselves immediately in the quest of food. They experience little difficulty in locating it, for at the time of birth a supply of food is found upon the egg shell. Here they feed from the first on the tiny blood pellicles surrounding the egg shell; this the mother furnishes when the egg is laid. When the last of the egg pellicles of blood are consumed the insatiable larvæ forage for other sustaining morsels. The dejecta of the adult flea seems to provide the desired ingredients. The young larvæ feed ravenously on the bloody deposits, apparently satisfied to pass the first few days on this unique diet. They can subsist entirely on the bloody fragments (flea fæces) when no other food is available, for a period of several days.

When food is not available the recently hatched larva nibbles its egg shell and that of its fellow (as yet unhatched). It gives evidecnce of its activity immediately after extricating itself from the egg shell, which it does head first or tail first according to the species. Whipping its way through the débris in great haste, it forages "on the run." It passes alongside an object, assays a nibble rather tentatively as if testing the quality of the food, rarely taking more than a single bite of any article.

One week after hatching the cuticle has darkened slightly but still remains quite transparent. One can readily see, with low-power microscope, as the insect feeds, how the food passes in dark masses through the mouth and along the alimentary tract, while the buccal cavity is moistened with bubbles of liquid arising from the salivary glands. The egg-opener at this stage (sixth day) has been retained, though its edge is somewhat blunted and worn.

In a batch of eggs the first larva hatched is generally, perhaps invariably, the largest. After it has hatched it chews off the bloody particles from its own shell, then nibbles on that of the others of the family prior to their hatching.

A larva of *P. irritans* was seen to emerge from the egg with head first, the tail wedged in the egg shell. The tail was freed from the shell by a relentless butting of its head against the shell where the tail was lodged. There is some evidence, from the eggs observed, that *L. cheopis* and *C. fasciatus* on the contrary emerge tail first.

The larvæ of *C. fasciatus* can live without feeding (i. e., in artificial conditions) for four to six days; and in one instance three larvæ of this species fed for nine days on an exclusive diet of flea dejecta and egg shell débris.

The color of the larva is significant in the larval cycle. At birth and for a period of three days the color is waxy white; then the

larva feeds on bloody excrement and egg pellicles and the color of the food imparts a reddish-brown color to the internal organs of the young insect.

At the second moult this bloody color is lost, since the blood pellicles deposited by the parent have dried up and the diet is composed of dirt particles and other organic débris. We have found that the intestinal tract is cleared about the third week. At this time the color of the cuticle turns to grayish and then to buff, which color is uniform until the third moult prior to spinning of the cocoon.

GENERAL METAMORPHOSES.

The long life of our native parasites seems to be anticipated at the very incubation. Eggs of the various species are laid at all times. Oviposition has been observed during every month. The broods appear to be constant and irregular. The incubation stage of our eastern forms, taken from the observations of Pergande, consumes two to four days ordinarily. Two days is given as the incubation period for the *cheopis* in India. Our experience with this species indicates a duration varying from nine to thirteen days at room temperature. When eggs of this species were subjected to identical conditions in which wild rats were caged in the laboratory basement (at a temperature of 10° to 15° C.) the length of the egg stage was nineteen days.

Larval life is cited by American and English authorities as a minimum of eight days and a maximum of twenty-four days. The larval stage of our California fleas under laboratory conditions is rarely less than twenty-eight days, often thirty days, and sometimes longer.

Pergande found that the pupal or cocoon stage of the *Pulex irritans* varied from five to seven days in the summer months at Washington. Other authors working with this species give twelve days during the summer months. We have observed several instances of cocoon life during the warm days of September. Here a maximum of thirty days was spent in this stage. During the colder season this flea remained in the cocoon as long as thirty-four days.

The entire life cycle, including adult life, is given by several authors as four to six weeks. The advisory committee on plague investigations in India gives as the time necessary for the completion of the cycle of development (in the case of *L. cheopis*)—that is, from the egg to the imago—as twenty-one to twenty-two days.

The following is given as a type of the life cycle observed in *C. acutus*. This species was kept under observation from the moment the egg was laid by its parent. An hour after the egg was laid it was placed in a small vial with a little sawdust, sand, wheat grains,

and squirrel hair. It was allowed to develop in this environment until matured.

Stage of development.	Date.	Age (days).
	1909.	
Egg laid	May 4	
Hatched	May 12	8
Molted (second stage)	May 18	14
Molted (third stage)	May 28	24
Cocoon	June 9	36
Adult	July 10	67
Alive (never having been fed)	Aug. 11	99

The following table gives the length of time required for the various stages of several species (under different climatic conditions). The data from India were taken from the reports of the English advisory committee on plague in India. The data from Australia were gleaned from the "Reports of plague in Australia, 1903," by J. Burnett Ham; those from Europe were compiled from accounts of Raillet and others; those of the Atlantic coast from Howard and Pergande, and the Pacific coast data are the result of our experience in the San Francisco Bay region of California.

The cycle of development in different countries.

[Compiled from accounts of various authors.]

Country and species of flea.	Egg.	Larva.	Pupa.	Complete generation.
India: L. cheopis	2 days	1 week	7 to 14 days	21 to 22 days.
Australia: P. irritans	6 days	12 days	14 days	4 to 6 weeks.
Europe:				
P. irritans	4 to 6 days	11 days	12 days	4 to 6 weeks.
Ct. canis	2 weeks	12 days	10 to 16 days	5 to 6 weeks.
United States:				
Atlantic coast—				
P. irritans Ct. canis	2 to 4 days	8 to 24 days	5 to 7 days	2 to 4 weeks.
Pacific coast—				
P. irritans	7 to 9 days	28 to 32 days	30 to 34 days	9 to 10 weeks.
L. cheopis	9 to 13 days	32 to 34 days	25 to 30 days	9 to 11 weeks.
C. acutus	7 to 8 days	26 to 28 days	24 to 27 days	8 to 9 weeks.
C. fasciatus	5 to 6 days	24 to 27 days	24 to 26 days	7 to 8 weeks.

LONGEVITY OF THE CALIFORNIA FLEA.

The English workers in India ascertain the length of time which adult fleas live on rats as forty-one days. The longest life of this species on an exclusive diet of human blood was observed to be twenty-seven days. We have managed to keep this species (*cheopis*) alive for a period of thirty-six days by feeding on man. The length of life without feeding was also noted. This period varied in the experiments of the English commission according to the environment

in which the fleas were maintained. In the absence of liquid food supply, fleas could live in bran for six days, in gunny sacking, a similar time, and in sand with moist cow dung for thirteen days. From our observations we have found the majority of fleas of all species to die in five days unless a moist medium was provided.

As we have stated above rat and squirrel fleas may be kept alive for a considerable time when moisture is provided in some form. It is interesting to note that fleas which have never tasted animal food, having emerged from the cocoon and kept under the same conditions in similar material as fleas which were fed for several days and then starved, will prove longer lived. A number of specimens of *Ceratophyllus acutus* removed from a ground squirrel and kept in moistened wheat grains and sawdust lived for twenty-six days. An equal number of fleas of the same species bred from cocoons in the laboratory were kept without a host in a similar medium. One male lived thirty-eight days and a female lived for sixty-five days.

In a series of experiments in which fleas taken from healthy rats and squirrels were fed daily on the arm of a man, we attempted to determine the maximum longevity of these parasites. The fleas were placed individually in open test tubes and at feeding time the tubes were inverted over the arm of one of the laboratory attendants. Fleas were thus applied daily for a period of from five to fifteen minutes, but only the actual feeding time was recorded. The average was about five minutes.

A *Læmopsylla cheopis* was fed for thirty-five days, escaping on the thirty-sixth day. One *C. acutus* died after fifty-eight days and another one at the end of fifty-one days. The common brown rat flea, *C. fasciatus*, proved to be the most persistent feeder of them all. Unfortunately one of them was permitted to escape after feeding on its induced host for sixty-three days. Another of the group suffered no ill effects from its enforced diet of human blood for ninety-eight days; and the sole survivor had been nourished by its foster host since its removal from the rodent host for a period of five months. The experiment was discontinued, but the parasite survived a week longer in a starved condition.

LONGEVITY RELATIVE TO SEX.

We have noted the relative longevity of the sexes under the conditions of experiments, in which fleas were fed on human blood alone. The experiments with each species were conducted during the same month and under similar conditions.

We shall take for consideration the two species common to rats, *L. cheopis* and *C. fasciatus*, and the predominant squirrel flea, *C. acutus*. Four tests with *C. fasciatus* give the following data:

C. FASCIATUS.

Six males of this species averaged eight and one-half days, the maximum life being seventeen days. Fifteen females gave an average of thirty-two and four-fifth days with a maximum of one hundred and sixty days. The two unfed controls (male) of this series lived for three days, and the two control females lived for five days.

L. CHEOPIS.

Two tests with a total of seven males of this species gave an average of ten and one-seventh days, and a maximum period of fifteen days.

Three females lived twenty-eight and one-third days as an average and a maximum period of forty-nine days.

The two unfed male controls lived five days, and in four females the average was five and one-half days and the maximum was seven days.

C. ACUTUS.

One test with this species furnishes the following data: Three males averaged eleven days, and in fact all died on the eleventh day.

Five females averaged fifteen and one-fifth days. The longest life was fifty-three days.

The unfed males averaged three days and showed a maximum of four days. The female control lived five days.

The greatest length of life of a male of any species is seen to be seventeen days; and the maximum period for a female was one hundred and sixty days, somewhat over five months.

In these tests for longevity it should be borne in mind that no attempt is made to arrive at the initial age of the fleas, but the time is reckoned from the day of removal from the host.

An effort was made to determine the length of adult life of one species, *C. acutus*, by feeding the insect newly emerged from the cocoon. Ten specimens, emerging within a few hours of each other, were fed on the same day on human blood. One specimen, a female, lived for sixty-four days, at which time the experiment was discontinued. The unfed controls, as well as the specimens given a human blood diet, were kept in ordinary test tubes at room temperature. The activities of these fleas may have been influenced by changes in the temperature and the absence of moisture in the tubes.

THE REACTION OF FLEAS TO LIGHT.

In the matter of the reaction of fleas to light, no opportunity has been presented for the obtaining of accurate data with special apparatus. The observations were made in a cursory way under nearly natural conditions, and no attempt was made to distinguish the kinetic from the photic influences.

THE LARVA.

The larva is positively heliotropic up to the stage of the initial molt. The more advanced sluggish larvæ are repelled by the light. This is seen when examining the flea-breeding cages; a slight stirring of the nesting material attracts to the surface the tiny very active larvæ. If the older larvæ are desired, it is found necessary to nearly invert the container. Prior to the final molt, when the larva is in readiness to pupate, it can be seen almost invariably along the edges at the bottom of the box, where the greatest number of cocoons are brought to view.

THE ADULT FLEA.

Rodent fleas are negatively heliotropic (repelled by light) to a very striking degree. The first impulse seems to be to seek protection from the light. This is seen in combing a squirrel or rat recently killed; the fleas will retreat constantly to the underside, always in the direction away from the light. When shaken off, they return to the shadow of the host; in numerous instances when the animal was dead for a period ranging from twenty-four to fifty hours, the fleas when shaken off would seek the host and bury themselves under the hairs away from the light.

When a number of live squirrel fleas and rat fleas were placed in an open test tube, and held horizontally, with the operator's thumb covering the mouth of the vial and the bottom held against the window, the fleas crowded toward the open mouth in the direction of the thumb, bounding away from the window in an excited manner. When the tube was reversed with the open mouth toward the window, it was found unnecessary to plug the mouth of the tube, as the fleas did not attempt to jump out when given an opportunity to do so. Even when placed within a half inch of the open end of the tube with the head of the insect turned toward the light, the fleas reversed and jumped toward the closed end of the tube. This was repeated by tilting the mouth downward to offer an easier exit through the open mouth, but even this inducement did not influence the fleas, which invariably sought the closed end of the tube in the shadow. This was tried with squirrel and rat fleas, as well as with human fleas, and always with the same result.

NOTES ON THE FEEDING PROCESS.

There is a remarkable degree of variation in the feeding habits of the different species of fleas. We have not attempted, except in a superficial way, to study the idiosyncrasies of the rodent fleas in regard to the biting of their normal hosts. We have, however, quite thoroughly observed the manner of biting under experimental con-

ditions with man as a host. Without taking into account the attraction or repulsion which may be exerted toward man as a host, we shall consider the more striking features of the biting of the parasites. We find that the species do not all attack with equal avidity. *Pulex irritans*, the normal parasite of man, is insatiable in its blood craving. It differs in its relation to man in being more fastidious in its feeding than the rodent fleas. Although its bite is painful, it does not voluntarily feed in one spot for any great length of time. The *Pulex irritans* differs from all other species (hundreds of specimens of which were tested on human hosts) in that it squirts blood per anum during the act of biting.

The *L. cheopis* and *C. fasciatus*, the normal rat parasites, are found to bite man with equal readiness and will live about the same length of time when fed on human blood. Their biting is well defined and effective, but not nearly so painful as that of *Pulex irritans*, nor so prolonged as that of the common squirrel flea, *Ceratophyllus acutus*. A specimen of *C. acutus* when starved for several days has been observed to feed on man uninterruptedly for a period of nearly one hour (fifty-nine minutes) at one insertion of its proboscis.

The bite of the *Ctenopsyllus musculi*, the blind flea of the mouse, is the feeblest we have had inflicted from any flea tested. The short, weak, piercing organs of this species make a puncture, which is scarcely perceptible. In observing the length of time this flea bites it is necessary to depend as a guide on the distention of the abdomen with blood rather than the prick of the mandibles. The *musculi* seems not able to adapt itself as an induced parasite of man; from a few experiments it appears to live not longer than five days on a human host.

The *Ceratophyllus acutus*, which proves a very ready parasite of man, makes its attack even under natural conditions as well as those of an experiment. Our data compiled from reports and collections of squirrel hunters shows that this species, as well as the other common squirrel flea, *Hoplopsyllus anomalus* Baker, will bite man when exposed to their attacks.

The unusually long rostrum in the *C. acutus* is presumed to be the cause of its prolonged feeding at one insertion of the mouth parts. A correlation between length of sucking organs and the time required for feeding has been noted in other insects.

The following is the description of the method of feeding observed in *C. acutus*. This method is typical.

The flea when permitted to walk freely on the arm selects in a few minutes a suitable hairy space where it ceases abruptly in its locomotion, takes a firm hold with the tarsi, projects its proboscis, and prepares to puncture the skin.

A puncture is drilled by the pricking epipharynx, the sawtooth mandibles supplementing the movement by lacerating the cavity formed. The two organs of the rostrum work alternately, the middle piece boring, while the two lateral elements execute a sawing movement. The mandibles, owing to their basal attachments, are, as is expressed by the advisory committee on plague investigations in India (Journal of Hygiene, vol. 6, No. 4, p. 499), "capable of independent action, sliding up and down but maintaining their relative positions and preserving the lumen of the aspiratory channel." The labium doubles back, the V-shaped groove of this organ guiding the mandibles on either side.

The action of the proboscis is executed with a forward movement of the head and a lateral and downward thrust of the entire body. As the mouth parts are sharply inserted, the abdomen rises simultaneously. The hind and middle legs are elevated, resembling oars. The forelegs are doubled under the thorax, the tibia and tarsi resting firmly on the epidermis serve as a support for the body during feeding. The maxillary palpi are retracted beneath the head and thorax. The labium continues to bend, at first acting as a sheath for the sawing mandibles, and as these are more deeply inserted, it bends beneath the head with the elasticity of a bow, forcing the mandibles into the wound until the maxillæ are embedded in the skin of the victim. When the proboscis is fully inserted, the abdomen ceases for a time its lateral swinging.

The acute pain of biting is first felt when the mandibles have not quite penetrated and subsequently during each distinct movement of the abdomen. The swinging of the abdomen gradually ceases as it becomes filled with blood. The sting of the biting becomes gradually duller and less sensitive as feeding progresses. The movements of the elevated abdomen grow noticeably feebler as the downward thrusts of the springy bow-like labium become less frequent.

As the feeding process advances one can discern through the translucent walls of the abdomen a constant flow of blood, caudally from the pharynx, accompanied by a peristaltic movement.

The end of the meal is signified in an abrupt manner. The flea shakes its entire body, and gradually withdraws its proboscis by lowering the abdomen and legs and violently twisting the head.

When starved for several days the feeding of the rat fleas is conducted in a rather vigorous manner. As soon as the proboscis is buried to the full length the abdomen is raised and there ensues a gradual lateral swaying motion, increasing the altitude of the raised end of the abdomen until it assumes the perpendicular. The flea is observed at this point to gain a better foothold by advancing the fore tarsi, and then, gradually doubling back the abdomen, it turns with extreme agility, nearly touching with its dorsal side the skin of

the hand upon which it is feeding. Meanwhile, the hungry parasite feeds ravenously.

It is interesting to note the peculiar nervous action which the rodent fleas exhibit immediately when the feeding process is completed or when disturbed during the biting. Even while the rostrum is inserted to the fullest the parasite shakes its head spasmodically; in a twinkling the mouth is withdrawn and the flea hops away.

POSSIBLE VITAL CONSIDERATIONS INVOLVED IN FEEDING HABITS.

We have previously noted that rodent fleas can live in a starved condition, away from the host, during a period of three to ten days, when kept in dry test tubes—as long as twenty-eight days when a suitable moist medium is furnished. The long periods of starvation appear not to affect the vitality of the parasite to such an extent that the ability to feed is impaired. We have recorded instances in which a specimen of the squirrel flea, *H. anomalus*, starved for sixteen days, and several specimens of *C. acutus* starved for twenty-seven days had sufficient energy to feed ten to fifteen minutes when an arm was placed in the breeding jar. These facts led us, with others, to accredit in a measure the claims of older authorities on plague, who contended before the flea theory was recognized that clothes and baggage of an infected community harbored the germs of plague, which remained viable during long periods of time. Modern writers have called our attention to the plausibility of infection in clothes and baggage, due to the agency of fleas, which may be transported from infected communities. Bannerman (Journal of Hygiene, 1906, vol. 6, pp. 189–199), writing on the possibilty of the spread of infection by means of clothes, brings forth several instances in which conveyance of infection by clothes seemed the most likely means of introduction of plague in some villages in India. Plague-infected rat fleas secreted in the clothes en route are held responsible for the transmission. Bannerman cites an instance of plague transmission through clothing where as much as ten days elapsed in the tranportation of clothing removed from a plague-infected victim and worn by a relative of the deceased, who in turn contracted plague.

THE PROLIFICNESS OF C. ACUTUS.

HOW MANY YOUNG WILL ONE FEMALE PRODUCE?

The "Reports of the advisory committee on plague investigations in India" (Journal of Hygiene, 1908, vol. 8, No. 2, p. 243), cites an experiment in the reproduction of *L. cheopis*. In this instance 200 fleas of both sexes were placed on rats as the host. The experiment was conducted by placing 40 fleas on each of 5 rats. The eggs of

these fleas were removed at intervals and permitted to develop to maturity.

At the end of the third week the fleas produced	86
At the end of the fourth week the fleas produced	329
At the end of the fifth week the fleas produced	527
At the end of the sixth week the fleas produced	456
Total production in six weeks	1,398

The following experiments were conducted in San Francisco for the purpose of ascertaining the reproductive powers in a single flea:

The fleas provided in this experiment were of the species *C. acutus* kept under observation during the cocoon stage. They were collected within twenty-four hours of the emergence from their cocoons and not permitted to feed. We may state in this connection that ordinarily the newly emerged insect does not feed for as much as three days, at which time it has quite dried and the chitin begins to harden. The new insects were examined with a lens and segregated as to sex. They were distributed among the hosts (white rats) in the following numbers:

	Males.	Females.
Series 1.		
Cage 1	3	1
Cage 2	9	3
Cage 3	15	5
Series 2.		
Cage 4	6	[a]6

[a] Collected *in copulo* while on the live squirrel.

These parasites were placed in small flea-proof boxes with a layer of wheat grains and sawdust and a small white rat for a host. The rat was fed on wheat and fresh carrots and enough fresh sawdust was added from time to time to absorb the moisture which accumulated.

In series 1 the fleas were distributed in the proportion of 3 males to every female, to insure the fertility of the latter, as we have learned from numerous observations that the male assumes the passive role in the copulatory act.

In series 2 the fleas used in cage 4 were taken from a squirrel by means of a camel's hair brush dipped in ether. Six pairs of these fleas while stupefied were placed in the cage with the white rat. This series was used to check the results of series 1, since we were not able to determine at what age breeding takes place.

During the time the rats were used to feed the parasites the bedding of the cage was not removed, so that the natural conditions for flea

development were maintained. A layer of dry sawdust was sprinkled in the cages every week.

Five weeks elapsed before the hosts were removed from the cages. They were carefully combed, and the fleas obtained from this source, as well as those collected from the bedding, were placed in glass vials to ascertain if more eggs would be deposited. After two weeks no eggs were found in the vials, therefore, it was assumed that oviposition was completed. The flea breeding boxes were placed in a flea-proof closet of the laboratory and examined occasionally.

The fleas as they emerged were anæsthetized and examined microscopically to insure against "hold overs" having escaped the vigilance of the observer at the time the host was removed. The appearance of the stomach contents in the absence of mammalian blood, and the "new" appearance of the parasite were certain criteria that the flea had recently emerged. In all the cages it was interesting to note that males made their appearance one to three days prior to the females.

The fleas first to emerge were observed on February 16, 1910, in cage 4, where the parent fleas were placed on the host December 8, 1909. ten weeks previously. The last fleas to emerge from this box were collected within three days of the appearance of the first.

The total number of fleas produced from the six females was 183, an average of 30.5 per female.

In the other series of three cages the fleas emerged, as anticipated, at a later date than the progeny of those found mating. The first to appear in this series was a male, the product of cage 2. The date of emergence was March 23, 1910, after a period of fifteen weeks.

Emergence occurred in this series during a period of ten days. The boxes were observed ten days longer before they were discarded. The following enumerates the results of the reproduction of these fleas:

	Females used.	Number produced.
Cage 1	1	9
Cage 2	3	60
Cage 3	5	114
Total fleas produced		183
Average per female		20.3

In this test to determine the number of fleas produced by a single female we must not overlook certain salient factors.

There is doubtless a seasonal variation in the different broods due to environmental changes. Although this species, *C. acutus*, lays eggs at all seasons of the year, it is probable that the number deposited and the percentage hatched fluctuate markedly. Other considerations

would include the change of host from squirrel to white rat and the fact that animals in cages, especially white rats, clean themselves of parasites. It is perhaps needless to state that a study of this nature would entail observations covering a long period of time in order to obtain accurate data.

SEASONAL DISTRIBUTION OF RAT FLEAS.

Breeding experiments with rat fleas of the species *C. fasciatus*, *L. cheopis*, *Ct. musculi* convince us that propagation takes place in all seasons. Flea-breeding cages supplied with a rat for a host furnished new fleas in every month of the year 1909. Fleas removed from these rats at all times laid eggs which produced larvæ, and despite the fact that these cages were drained of fleas constantly for experimental purposes, to the extent of 1,500 *C. fasciatus* from one cage, at the end of one year there was no apparent diminution in numbers of parasites in the adult form. The entomologist of the advisory committee on plague investigations in India (Journal of Hygiene, 1908, vol. 8, No. 2, p. 242) found that in Bombay the *L. cheopis* bred in every month for one year, February, 1906, to February, 1907. However, flea breeding in the month of June was found to be not so vigorous as during the rest of the year.

In relation to the prevalence of rat fleas in California due to seasonal variations we shall consider mainly the ecological phases. The occurrence of epizootic plague in various countries has prompted several investigators to carry on extensive enumerations of fleas taken from rats. The workers in India and in Australia have established beyond doubt a direct correlation in occurrence of rat plague to rat fleas.

The tremendous "clean up" during the recent epizootic of plague in San Francisco has probably influenced the flea count of rats trapped in that city. The destruction of innumerable rat harbors and rat nests during the sanitary campaign interferred materially with the normal conditions of parasitism in these rodents. The nest of rodents generally is the ideal collecting ground for fleas, and in adapting themselves to the environmental changes induced by the federal sanitarians thousands of rats were driven from their normal nesting places into the sewers where they were trapped and brought to the laboratory and examined by us for their parasites. The search for fleas on these animals proved not very fruitful, as we soon learned that the sewer produced anything but optimum conditions for flea life. The live rats examined were in the main taken from city sewers, consequently our records prove unserviceable for the present discussion.

The conditions found in the towns of Berkeley and Oakland, present for our purposes better normal faunal interrelations. We shall omit the consideration of epidemiology by presenting data gleaned during nonepizootic times, a period embracing an enumeration of twelve months.

These counts were made and reported to us by Mr. August Venzke, laboratory assistant at the Oakland branch of the plague laboratory. We are greatly indebted to this careful painstaking collector for the data presented.

In order to prevent the fleas from leaving the rats while the latter were being transported in bright daylight or sunlight, the method of procedure selected by the last Indian plague commission was adopted by Acting Asst. Surg. William B. Wherry, then in charge of the Oakland branch laboratory, as follows:

When a rat catcher approaches a trap containing rats he places rats, traps, and all in a heavy canvas bag, which is tied securely and sent to the laboratory where the rats and their fleas are chloroformed simultaneously and a careful search is made on the body of the rat and through the contents of the bag for fleas.

The table following shows the results obtained.

Month.	Rats trapped.	Fleas collected.	Rats without fleas.	Average fleas per rat.	Monthly mean temperature.
1909.					°F.
January	38	93	12	2.44	51.0
February	360	1,274	65	3.53	50.8
March	409	1,458	43	3.56	51.9
April	531	1,127	192	2.12	58.0
May	604	1,201	159	1.98	58.4
June	739	2,534	183	3.42	61.8
July	617	1,497	141	2.42	63.8
August	447	1,232	79	2.75	61.8
September	317	903	55	2.82	62.8
October	321	1,213	42	3.77	58.8
November	296	811	56	2.77	53.3
December	237	328	69	1.38	47.9
Total	4,916	13,671	1,096	32.96	
Yearly average fleas per rat				2.74	

Judging from the table of the flea census for the twelve months we find but a slight variation in the general average of fleas per rat. Here we find a relatively even balance preserved in flea infestation throughout the year. The average number of fleas to each rat per month is not materially influenced, according to our table, by the monthly mean temperature.

The variation in the individual infestation of the rats enumerated in the monthly census shows all gradations of 99 fleas to one rat, 89 fleas to 2 rats, 37 fleas to 3 rats, and 1 flea among 5 rats. During the height of the plague epizootie, September, 1907, Acting Assistant Surgeon Wherry collected as many as 342 fleas from a single rat.

THE USE OF ANIMALS FOR FLEA TRAPPING.

Due to the successful experiments of the British Indian commission in the use of guinea pigs for trapping fleas (*L. cheopis*) in plague-infected houses, it was thought that these animals would prove of service in collecting fleas in houses in San Francisco.

Four experiments with guinea pigs were conducted by us in houses heavily infested with fleas. In every instance the animals were kept overnight in the basement of the house. Some of them were permitted to roam at large, others were exposed in wire cages to the attacks of the fleas. The "controls" used in these experiments were "tanglefoot" paper and the bare legs of the investigators.

In the first experiment 179 fleas were removed from the legs of two attendants who entered the house long enough to distribute the animals. The "tanglefoot" paper left overnight in the region of the cages trapped 232 fleas. The 6 guinea pigs yielded 2 fleas, *P. irritans.* Three other experiments of a similar character were tried in houses during the year 1909. A summary of the results of the four experiments is shown in the following table:

Animals used.	Fleas trapped by animals.	Fleas caught in tanglefoot.	Fleas taken from men.
	P. irritans.	*P. irritans.*	*P. irritans.*
6 guinea pigs	2	232	179
4 guinea pigs	4	428	60
6 guinea pigs	8	451	222
6 guinea pigs	3	120	12
22 guinea pigs	17	1,231	473

In another experiment guinea pigs were used to trap fleas in a house where dogs were responsible for the invasion of the parasites. The fleas taken from the 12 adhesive papers numbered 1,192, of which 836 were *P. irritans* and 356 were *Ct. canis.* Four guinea pigs yielded 9 specimens of *Ct. canis* and 2 specimens of *P. irritans.*

Results of much the same character have been reported by the advisory committee on plague investigations in India (Journal of Hygiene, 1908, vol. 8, No. 2, p. 248). Here the use of guinea pigs for trapping cat and dog fleas did not prove fruitful. In these experiments where man and guinea pig were simultaneously used to trap the fleas, it appears "that man is selected in preference to the guinea pig by the cat flea."

Observations in houses on *P. irritans* cited by the same authors (p. 247) proved the guinea pig a poor flea trapper. They state:

> This flea, *P. irritans*, is very select in the choice of its host. We have found it almost exclusively on man. On one or two occasions only, has a human flea been noted on a rat or on a guinea pig.

In one experiment two guinea pigs were used in a house which had been vacant for several days; here the animals failed to attract any of the fleas, while a man acted as an admirable trap. Experiments with the rat fleas, *L. cheopis*, on the other hand, demonstrated that the guinea pig is an ideal flea trap for this species. We may say here that the rat flea, *L. cheopis*, has never been encountered in our experience in houses in San Francisco.

The guinea pig, we have found, makes an admirable trap for squirrel fleas, *C. acutus*. In one instance a guinea pig was placed five minutes in the laboratory basement, which was infested with squirrel fleas, and attracted 13 fleas. When this animal was left overnight in the same quarters it had trapped 138 fleas of the species *C. acutus*. We have used guinea pigs and white rats in parallel experiments to trap rat fleas, *C. fasciatus*, and squirrel fleas, *C. acutus*. The animals were kept in wire-cage traps and exposed idividually to the attacks of the fleas in large breeding boxes. Each animal was left in the flea box for ten minutes, removed, and anæsthetized. The fleas were collected and returned to the box. After a guinea pig was tested in this manner, a white rat, one-half hour later, was given the same treatment. Five tests were made individually with 5 guinea pigs and 5 white rats. The two species of fleas, *C. fasciatus* and *C. acutus*, were trapped from distinct boxes.

Fleas trapped by the animals.

	Specimens.
Five guinea pigs:	
C. fasciatus	88
C. acutus	385
Five white rats:	
C. fasciatus	220
C. acutus	28

We may conclude from these experiments that the guinea pig is selected in preference to the white rat by the squirrel flea, *C. acutus*, and the white rat is selected in preference to the guinea pig by the rat flea, *C. fasciatus*.

SOME PHASES OF THE OCCURRENCE OF PULEX IRRITANS.

In taking the census of the flea population of thousands of rats the observer is impressed by the correlation of the prevalence of the human flea in dwellings and on rats. It appears that the increase or decrease of *Pulex irritans* is synchronously parallel in human and rodent infestation.

The sanitarian can thus often keep informed of the nature of the rodent's haunts by the presence or absence of certain of these parasites, *P. irritans*. A sewer rat, for instance, is never found ordinarily to harbor human fleas; and during house-flea infestation the rat

trapped in the dwelling is quite certain to be accompanied by *P. irritans.* In July, 1908, during a severe invasion of *Pulex irritans* in certain quarters of San Francisco, the infestation on rats from this district amounted to 61.5 per cent of the *irritans.* In the month of March of the same year 1,469 rat fleas were examined, of which only 7 specimens were *Pulex irritans.* The census of the previous month revealed a total of 2 fleas of this species taken in a collection of 1,524 rat fleas. As far as we could determine, these two months yielded a very small number of human fleas in dwellings of San Francisco.

We may say without doubt that *Pulex irritans* is preeminently the flea found in houses and upon man on the Pacific coast.

At this juncture we may call attention to the difference in infestation of the houses of the eastern United States and that of those of California. Howard, writing of house fleas in Circular No. 108, February, 1909, United States Bureau of Entomology, states:

> Judging from the specimens of fleas sent to the Bureau of Entomology of recent years with complaints of houses being infested by them, the human flea (*Pulex irritans*) is not the species most likely to occur in great numbers in dwelling houses in this country, but rather the common cosmopolitan flea of the dog and cat (*Ctenocephalus canis*). This holds especially for the eastern United States.

Wherry (Journal of American Medical Association, 1908, vol. 51, No. 6, p. 495), writing on "Fleas on rodents and men on the Pacific coast," records the fleas collected during the period from October, 1907, to February, 1908. These parasites were gathered in the "worst infected district" of a plague focus from human beings, beds, and bedding. He cites the following species:

	Specimens.
Ceratophyllus sp.	2
Ctenocephalus canis	2
Pulex irritans	334

Doane in Notes on Fleas Collected on Rat and Human Hosts in San Francisco enumerates the species and numbers of fleas collected from human hosts and houses during February to June, 1908. In February fleas were taken from human hosts or on their clothing in the plague laboratory and hospitals and in refugee camps. There were 220 specimens, all of *Pulex irritans.* From March to June the total number of fleas identified from human hosts was 696 specimens; 693 of these were *Pulex irritans,* while 3 specimens were *C. fasciatus.*

Thus we find not a single specimen of *Ctenocephalus canis* in a collection of 916 fleas, covering a period of five months, taken from scores of men and houses.

Another list of fleas taken in California from man is recorded by McCoy and Mitzmain in Public Health Reports (1909, vol. 24, No.

29, p. 1018). Here we have enumerated a collection of fleas embracing a period of one year from 29 individuals.

Pulex irritans, 337 specimens; *Ctenocephalus felis*, 1 specimen; *C. canis*, 1 specimen, and *Ceratophyllus acutus*, 3 specimens.

We may conclude from these results that the human flea, *Pulex irritans*, is the normal parasite of man on the Pacific coast.

HIBERNATION OF PULEX IRRITANS.

In which stage and at what season does the human flea hibernate?

Observations were made by the writer during the winter months of 1907, 1908, and 1909 to determine in what stage of development the human flea, *P. irritans*, hibernates in California. During the course of this study he inspected 14 badly flea-infested dwellings, from which were collected the adult fleas, dust of the floors, and soil immediately under the houses. The parasites and the dirt collected were placed in separate vials in the laboratory, where they were carefully observed.

Note was taken of the egg laying and longevity under artificial conditions. It was a matter of interest to observe that the females which at warmer seasons lay five to eight eggs at a time, now deposited, at the most, two eggs, and the majority did not oviposit. In all cases the eggs laid failed to hatch. Another feature of interest in the winter forms appeared in the greater resistance to starvation and unfavorable conditions. Under these circumstances this species does not ordinarily survive beyond a period of five days. The wintering females averaged eight days, some surviving twelve days.

The organic matter, which was collected at the same time and in the same surroundings as the adult fleas enjoyed, was inspected from time to time for the development of flea life. These samples were kept for thirty to forty days to provide for the later development of any cocoons which might have been present. In no instance did we find the larval form of this flea; in only one instance did we find an adult flea which either developed from a cocoon or had been overlooked at the time the material was collected from the dwelling. Several instances of the egg stage were noted. These did not hatch, however, but shriveled after a few days.

We may add in this connection that temperature experiments with *P. irritans* have borne out the facts adduced from nature. Gravid females of this species were collected during the summer months and placed in shell vials in a refrigerator maintained at a temperature between 8° C. and 10.2° C. Under these conditions eggs were laid, but failed to hatch.

It is quite apparent therefore that the house flea, *Pulex irritans*, hibernates most probably in the winter in the adult stage.

As we have demonstrated, this species, in comparison to the rat and squirrel fleas, does not resist starvation for any considerable time, certainly not during the full period of the hibernating stage, which may extend to two months or ten weeks. By this we mean the period when man is free from their attacks. The question arises upon what host does this insect feed in the absence of man, the normal host. That is to say, what animal, if any, is the temporary host during the "interrupted" hibernation period. The host which naturally presents itself is that nearest to man and most accessible to the parasites. The dog is probably the host selected.

We have collected fleas from dogs during the winter months in the bay cities of Berkeley, Oakland, and San Francisco. In December, 1907, and January, 1908, when fleas in houses were rarely found, we collected fleas from 10 house dogs in Berkeley. The number actually collected was 456 fleas, although the animals harbored probably four times this number. The fleas identified were:

	Specimens.
Ctenocephalus canis	322
Pulex irritans	134

Twenty-nine per cent of the total catch were human fleas.

The writer in investigating the cause for the immunity of certain people to the biting of fleas has made extensive inquiries among his intimate associates as to the data of attacks by these parasites. From January 5, 1910, to March 30, 1910, reports of the flea infestation among persons ordinarily susceptible were very few. During this period we inspected three houses, the basements of which were swarming with fleas. The history of the infestation of the dwellings was similar in all of them. In each case the basement, the region of greatest infestation, was the harborage of two to three dogs which were more or less confined to these quarters. Six of these dogs were examined for fleas, when it was seen that 40–55 per cent of the parasites of each dog were *Pulex irritans*. The domiciles of these hosts were examined and many fleas collected. From the worst infested of the houses we collected overnight on adhesive paper 1,192 fleas which were identified as follows:

	Specimens.
Ctenocephalus canis	356
Pulex irritans	836*

Here we find 70 per cent of the fleas collected, with the dog as an occasional host, to be the house flea, *Pulex irritans.*

In a report of the fleas collected during the plague campaign in California (Public Health Reports, 1909, vol. 24, No. 29, p. 1019), Passed Asst. Surg. G. W. McCoy and the present writer recorded

the following parasites taken from four dogs during Februray and March, 1909:

Ct. canis.		P. irritans.		Ct. felis.		C. acutus.	
M.	F.	M.	F.	M.	F.	M.	F.
10	44	8	17	0	1	0	1
54		25		1		1	

In this enumeration 30 per cent of the fleas found were *Pulex irritans.*

During the warmer seasons we have collected fleas from dogs in San Francisco Bay regions and find a great preponderance of *Ct. canis.* Doane reports in Canadian Entomologist (August, 1908, p. 303), the identification of fleas from a Dachshund pup. These parasites were sent to him by former Acting Assistant Surgeon Wherry in the latter part of April, 1909. There were 477 specimens taken from the dog; without one exception the fleas were of the species *Ctenocephalus canis.*

With this somewhat meager data, we can not establish with faultless accuracy that the human flea is tided over the hibernation stage to a limited extent on the body of the dog, but we wish to suggest this as a plausible solution.

We have not had an opportunity to give the attention to the domestic cat in the same measure as the dog has been investigated, but we doubt not that the feline having similar environments would be influenced in this matter of parasitism to perhaps the same degree. We may state, however, in this connection, that an examination of a dozen cats during a period of two years revealed the presence of few human fleas.

THE CAUSE FOR THE UNEXPECTED APPEARANCE OF HOUSE FLEAS.

It was long held in the popular mind that in some quarters fleas were generated spontaneously. We may say that this impression from the layman's view point seems justified when it is known that the reason for the sudden appearance of fleas in houses is often obscure.

In Circular No. 13, United States Bureau of Entomology, Howard states that a housekeeper shutting up her house in June need not be surprised to find the establishment overrun with fleas when she opens it up again in September or October.

In Parasitology 1, page 10, March, 1908, appears a statement that observers have recorded that the flea propagates in deserted dwellings,

the adult insect not requiring food, at least for some time, to enable it to reproduce its species. An observation of a similar character is recorded by Euting, 1896, Reise in Inner-Arabien, page 11.

In common with these investigators we can cite a number of definite instances of this apparent spontaneity in house-flea infestation. However, this phenomenon is too well established for further needless substantiation.

We have, however, gathered experimental evidence as a control to our general observations. On numerous occasions we have accompanied the sanitary inspector on his rounds of many filth-infested refugee cottages, whence dust and débris were removed from cracks in the floors. This material was taken to the laboratory, placed in convenient flasks, and left undisturbed in a dark corner.

When first examined, no life was in evidence, some inert shells of the adult flea and moulted larval skins were observed. In one instance, when the flask was inspected, five weeks later, two live fleas appeared followed in ten days by fifteen additional active imagoes.

At other times the floor dust when gathered from a dwelling was supplied with many larvæ in various stages of development. These transformed into adult fleas when kept in the laboratory for a period of four to six weeks.

No doubt if the houses from which flea material were collected should be vacated and left undisturbed for certain periods, the swarm of fleas produced would indeed give the unfortunate housekeeper an impression of spontaneous generation.

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STUDIES UPON LEPROSY

IX. MOSQUITOES IN RELATION TO THE TRANSMISSION OF LEPROSY

X. FLIES IN RELATION TO THE TRANSMISSION OF LEPROSY

BY

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XI. HEREDITY VERSUS ENVIRONMENT IN LEPROSY

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Investigations made in accordance with
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MOSQUITOES IN RELATION TO THE TRANSMISSION OF LEPROSY.

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PART I.—INTRODUCTION.

In the nodular form of leprosy when fully developed we have a disease characterized by the appearance, in successive crops, of lesions of the skin varying in size from that of medium-sized papules to large nodules, and, by the coalescing of such lesions, massive and diffuse areas of infiltration.

These lesions are most apt to be located on the exposed surfaces, and especially on the face.

When an investigator punctures such a lesion and exerts pressure on the surrounding tissue, the mixture of blood and lymph thus obtained is usually, practically always, rich in lepra bacilli.

In the mosquito we have an insect that has a wide range of distribution and is often abundant. This insect feeds by puncturing the skin wherever uncovered, but more often on the face, and fills itself with blood. It later bites another person, who often mashes the blood-filled insect and thus smears the blood contained in the insect upon his own skin; this act is followed by rubbing and scratching the site of the puncture.

Thus we see that the mechanism is complete for the occasional transfer of a leper's *blood* to the skin of a healthy person, and by scratching and its accompanying trauma such blood is sometimes rubbed into hair follicles or even into the lymphatics. Whether the blood that the insect has imbibed from a leper contains the bacilli, and whether such bacilli if imbibed remain in the insect a reasonable length of time, are questions the answer to which determine whether the mechanism for the transfer of the bacillus of leprosy from afflicted to healthy persons is or is not complete.

To determine this is the object of this investigation. It must be borne in mind, however, that even if it can be shown that the bacilli are thus transferred there still remains a doubt as to whether this constitutes a means of infection. We shall not deal with that point; in our present state of knowledge only human inoculations could

determine it. A hasty review of the literature upon that phase of the subject of transmission shows some forty-odd cases of alleged human inoculations, mostly on or under the skin, with but a single, doubtful, case of infection following (Arning's case), the other inoculated persons not developing the disease.

The only phase of the subject we are dealing with here is, Do mosquitoes contain lepra bacilli when allowed to feed, under natural conditions, upon the skin of lepers presenting many lepra nodules? If they do contain the bacilli, then the mechanism for the transfer of the bacilli is complete, and the insect *may* be a factor in the transmission of the disease. If it does not contain them, then this insect can be excluded as a factor in the transmission of this disease.

In considering this subject we are aware of the fact that no amount of negative evidence absolutely answers the question, "May it not sometimes occur?" but from the incidence of the disease at certain times, and in certain places, we know that some well-defined and frequently acting mechanism or mechanisms exist for its transfer, and we seek to discover if this insect is one of these. The eradication of infectious diseases must rest upon the discovery of the *usual* means of transmission, and rare or accidental means are of no practical importance.

From the above it would appear, upon theoretical grounds, that the transfer of the bacilli is probable; a disease characterized by bacilli-filled lesions on exposed surfaces, together with the well-known habits of this insect of imbibing blood from the skin of such exposed surfaces, would easily explain the fact that this insect fell under suspicion as a means of transmission. But it must be remembered, also, that although the investigator finds bacilli in the blood obtained from puncturing a lepra nodule, this insect employs a similar but not identical method of blood abstraction.

REVIEW OF THE LITERATURE.

Leloir,[a] 1886, thought mosquitoes possible agents in the transmission of leprosy.

Ashmead,[b] 1890, believes lepra would be found to have an intermediate agent, either a fish or an insect.

Arning,[c] 1890, states that he has examined "hundreds" of mosquitoes caught in the bars over lepers, but he has never found the lepra bacillus in the insects.

[a] Traité pratique et théorique de la lèpre, quoted by Marchoux and Bourret in Lepra, vol. 8, p. 120.

[b] Lepra in Japan. Ist ein Zwischenwirt bei der Verbreitung beteiligt? Journ. of Cut. and Gen.-Urin. Diseases. Referred to in Baumgarten's Jahresbericht, vol. 6, p. 255.

[c] Lepra mit besonderer Berücksichtigung der Uebertragung durch Heredität oder Contagion. Referred to in Baumgarten's Jahresbericht, vol. 6, p. 247.

The same author the following year [a] mentions that lepra and mosquitoes entered the Hawaiian Islands at nearly the same time.

Of this latter statement we desire to further refer to Ashburton Thompson's article "Leprosy in Hawaii" (1898), in which he shows that the claim that leprosy entered these islands at the time referred to rests on very uncertain data, and may or may not be true.

Joly,[b] 1898, states that Sabrazes believed that leprosy might be conveyed by numerous small inoculation from insects.

Sommer,[c] 1898, expressed the belief that mosquitoes act as active agents in the spread of leprosy in warm countries. In referring to this Nuttall comments, "this is very unlikely."

Hutchinson,[d] 1899, gives six reasons against the probability of leprosy being spread by mosquitoes.

Scott,[e] 1900, believes that mosquitoes acted as transmitters of leprosy in the Hawaiian Islands.

Chantemesse,[f] 1901, favors the mosquito hypothesis as explaining the spread of leprosy.

Joly,[g] 1901, does not regard mosquitoes as transmitters, as Europeans are often bitten and rarely develop the disease.

Hallopeau,[h] 1901, favors the mosquito hypothesis as explaining the transmission of leprosy.

Blanchard,[i] 1901, states that leprous countries are also mosquito countries.

Tonkin,[j] 1902, believes that mosquitoes, by causing scratching, favor infection with leprosy in the Sudan where lepers sell soiled clothing.

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[a] Archiv für Dermatol. und Syph., No. 1, and referred to in Lepra, vol. 8, p. 120.

[b] Importance du rôle des insectes dans la transmission des maladies infectieuses et parasitaires. Du formol comme insecticide. Referred to by Nuttal in Johns Hopkins Hospital Reports, vol. 8, p. 33.

[c] Leprosy in the Argentine Republic. Sem. Med. of June 23, 1898, and referred to by the Journal of American Medical Association, September 10, 1898; by Nuttall in Johns Hopkins Hospital Reports, vol. 8, p. 34; by Marchoux and Bourret in Lepra, vol. 8, p. 121.

[d] Is leprosy spread by mosquitoes, etc.? Archives of Surgery, vol. 10, No. 37, p. 59. Referred to in Baumgarten's Jahresbericht, vol. 15, p. 391.

[e] Contagiousness of leprosy. British Medical Journal, September 29, 1900. Reviewed in Lepra, vol. 8, p. 177, and referred to by Marchoux and Bourret in the latter publication, vol. 8, p. 120.

[f] Bull. de l'Acad. de Méd., July, 1901. Referred to by Marchoux and Bourret in Lepra, vol. 8, p. 120.

[g] Lèpre à Madagascar. Arch. de Méd., Nov., 1901. Referred to by Lepra, vol. 3, p. 57.

[h] Leçons cliniques de l'hôpital. Bull. de l'Acad., July, 1901. Referred to by Marchoux and Bourret in Lepra, vol. 8, p. 120.

[i] Bull. de l'Acad. de Méd., July 30, 1901, and Archive de parasitologie, 1901. Referred to by Marchoux and Bourret in Lepra, vol. 8, p. 120.

[j] Some general and etiological details concerning leprosy in the Sudan. Royal Med. and Chir. Soc. of Londo[illegible] ferred to in Lepra, vol. 3, and Baumgarten's Jahresbericht, N[illegible]

Noc,[a] 1902, does not believe in direct contagion, but considers the bite of the mosquito a possible means of spread.

The same author,[b] 1904, believes mosquitoes helped to spread leprosy in the Loyalty Islands. On one of these islands there were few mosquitoes and the disease spread very little.

Jeanselme,[c] 1906, states that the spread of leprosy in New Caledonia is probably increased by mosquitoes.

Goodhue,[d] 1906, claims that after many failures he and Father Joseph discovered lepra bacilli in a female culex.

Black,[e] 1906, states that it has not yet been determined whether insects played any part in the spread of leprosy in Cape Colony.

Smit,[f] 1906, rejects the idea that insects are factors in the spread of leprosy.

Miser,[g] 1906, refers to Joly's and Sabrazès's opinions in the matter. (Vide supra.)

Hallopeau,[h] 1906, states he believes that mosquitoes are factors in the spread of leprosy.

Brinckerhoff,[i] 1908, states "the fact that the female culex defecates at the time of biting makes it possible that the insect may act as carrier of leper bacilli from lepers to well persons. The data now available does not permit of a positive statement that the mosquito functions in the transmission of leprosy, and the probabilities are against such a conclusion." He established the fact that the mosquito defecates at the time of biting, and in the same paper reports having seen acid-fast bacilli in a preparation stated to have been made from a mosquito that had fed on a leper.

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[a] Fonctionnement du laboratoire de bactériologie de Nouméa (N.-Calédonie). Annales d'hygiène et de méd. colon. Referred to in Baumgarten's Jahresbericht. vol. 19, p. 355; also Lepra, vol. 4, p. 208.

[b] La lèpre aux Iles Loyalty. Annales d'hygiène et de méd. colon., vol. 7, No. 1, p. 5; also referred to in Lepra, vol. 4, p. 186, and in Baumgarten's Jahresbericht, vol. 20, p. 507.

[c] In a report of Hallopeau and de Lepinay, entitled, "Nouvelle poussée de nodules érythémateux chez une lépreuse." Soc. franç. de dermatol. et de syphil., vol. 17, p. 378, and referred to in Baumgarten's Jahresbericht, vol. 22, p. 327.

[d] Boston Med. and Surg. Journ., 1906; American Medicine, Oct., 1907; Journal of Trop. Med., September 15, 1906; Indian Medical Gazette, 1906; Lancet, May 12, 1906; Lepra, 1907, p. 64. Also commented on by Ehlers in 1909 in Report of Danish-French Commission, presented at Bergen.

[e] Remarks on leprosy in Cape Colony. Centralbl. f. Pathol. u. pathol. Anat., Bd. 17, p. 476.

[f] Leprosy in Argentine. Arch. f. Dermatol. und Syph., vol. 91, p. 389.

[g] Prophylaxie des maladies exotiques. Baumgarten's Jahresbericht, vol. 22, p. 343.

[h] Brouardel-Gilbert: Maladies exotiques, p. 280. Referred in Baumgarten's Jahresbericht, vol. 22, p. 337.

[i] A note upon the possibility of the mosquito acting in the transmission of leprosy. Bull. of the Leprosy Investigation Station, Kalawao, Molokai, U. S. P. H. & M. H. Service.

Matias Duque,[a] 1909, states that Doctor Agramonte had shown him a preparation made from a mosquito which showed lepra bacilli, and that he had observed them in others since, but he does not believe these insects play any part in its spread.

MacLeod,[b] 1909, states "so far the microbe has not been found in the mosquito."

Ehlers [c] states that they (the Danish-French commission) obtained negative results in their search for lepra bacilli in these insects even when the latter were allowed to feed upon leprous nodules. The explanation of this fact is not clear, but he believes that it may be due to the mosquito puncturing a small vessel and obtaining lymph-free blood, while the investigator when he punctures a nodule obtains a mixture of blood and lymph.

Bourret,[d] 1909, states that:

First, he captured from lepers' homes three *Stegomyia fasciata* (*callopus*); examined one after one hour, one after two hours, and one after three hours, but in none did he note the lepra bacillus.

Second, he allowed two *Culex*, two *Anopheles*, and two *Stegomyia* to bite over a leprous nodule and examined the insects, some after fifteen minutes and the rest after an hour with negative results.

Third, he repeated this experiment on a case of nerve leprosy with negative results.

SUMMARY OF THE LITERATURE.

Aside from those authors who hold views on this subject apparently based on theoretical grounds, we also have the following:

Those who searched in vain for the bacillus of leprosy in the mosquito are—

Arning, who has examined "hundreds" of these insects caught under the bars of lepers.

Ehlers (Danish-French commission), that actually placed the captive mosquitoes over nodules and allowed them to feed.

Bourret, who examined three mosquitoes from lepers' houses and six mosquitoes that had fed on leprous nodules.

Of those that have seen acid-fast bacilli in mosquitoes that were believed to have fed upon lepers we have—

Goodhue, Brinckerhoff, and Matias Duque. The two former in a single insect; the latter's statement does not contain information as to the number of insects he has observed containing the bacilli.

PRELIMINARY REMARKS.

The following data have been obtained by work performed at the laboratory for the investigation of incipient cases of leprosy at Hono-

[a] Sanidad y Beneficencia. Habana, June, 1909, p. 384.

[b] Lancet, August 21, 1909, and read at Bergen, August 16, 1909.

[c] Transmissibilité de la lèpre par les insectes suceurs de sang, read at Bergen.

[d] Quelques recherches sur la lèpre. Lépra, vol. 8, p. 128.

lulu, being a branch of the United States leprosy investigation station at Kalawao, Molokai.

The portion of Honolulu where this branch laboratory is situated is infested with the *Culex cubensis* throughout the year, but in our experience in the autumn and winter the *Stegomyia callopus* are rare in this exact locality, while the *Stegomyia scutellaris* has not been observed there by me.

These three varieties are the only mosquitoes known to exist on these islands. The above facts account for all the mosquitoes examined being of one species. During these experiments we succeeded in securing only three individual specimens of *Stegomyia callopus;* these we had intended to utilize by having them bite lepers' nodules, but administrative duties made it necessary for us to go to Molokai, and for this reason the three were used for another purpose, to be described later.

Arriving at Molokai station, we discovered that owing to the cooler temperature and high winds of this time of the year no mosquitoes were procurable, so decided to publish the data already obtained and later to report upon the contemplated work of having caged mosquitoes bite a large number of leprous nodules.

The necessity of obtaining the *Stegomyia* in this latter work is due to the fact (observed here by Brinckerhoff) that this *Culex* will not bite when confined to a small space, and in order to force the insect to feed upon a nodule confinement to a large test-tube or wide-mouth bottle is necessary.

PRELIMINARY WORK.

Our first object was to ascertain whether mosquitoes, when captured in a locality in which there was no possibility of their having fed upon lepers, contained acid-fast bacilli of any kind in their intestinal tracts; also whether they showed anatomical structures which might from shape and staining reaction be mistaken for acid-fast bacilli.

With this object in view we obtained 21 specimens of *Culex cubensis* from a noninfected district, some of these having fed upon the healthy occupants of the house in which they were captured.

The abdomen was cut from the thorax and opened and the intestines and their contents crushed and smeared upon a glass slide. This preparation was then air-dried, stained from three to five minutes in Ziehl-Nielson carbo-fuchsin, washed in water, treated with 1 per cent nitric acid in 70 per cent alcohol for ten seconds, washed again in water, dried, and examined with the 1:12 oil immersion lens (Zeiss).

This method of examination was employed in all of the insects mentioned in this publication and so will not be referred to again.

The examination of the 21 insects mentioned showed no acid-fast bacilli or bacteria of any kind.

Numerous fibrils, varying in shape, size, and appearance (broken bits of the scales that cover parts of the insect) were noted as holding their stain against acid alcohol. These structures for the most part could be differentiated at a glance upon size and shape alone, but occasionally it was observed that small broken fragments required careful observation before passing them by; however, we saw no structure which a reasonably experienced person should mistake for an acid-fast bacillus.

Hoping to secure a method that would deprive these structures of their acid fastness without robbing the lepra bacillus of its color, and thus rule out even this very slight source of error, we took smears of human and rat lepra bacilli and smeared mosquitoes over them (these insects not being included in the 21 mentioned), after which these slides were dried, fixed, and stained.

These were treated with many stains and mordants, with the results that while an occasional slide was secured in which the bacillus was brilliantly red while the structures mentioned had as different a color as blue black, the rule was failure, these structures being nearly as acid-fast as the bacilli themselves. The most practical point learned was to avoid staining the slide longer than absolutely required (three minutes), as the bacilli acquired the stain somewhat quicker than the scales did.

While not "preliminary work" in one sense, as it was the last work performed, the experiment about to be described properly belongs under this designation.

We sought for an explanation of the statements of Ehlers and Bourret that mosquitoes drawing blood from a bacilli-filled nodule did not contain the bacilli in their blood-filled intestines. If this observation were correct, then there seemed to be but two possible explanations:

First. That the bacilli were not contained in the fluid that the mosquito drew, even though the investigators, in attempting to imitate the mosquito, drew the fluid from the same nodule.

Second. That the bacilli are rapidly destroyed in the intestinal tract of the mosquito.

Any filtration process could be excluded, both from the anatomy of the mosquito and from the fact that blood corpuscles passed into the insects' intestinal tracts without difficulty.

While to us the second supposition seemed quite improbable, it was considered advisable, if only to exclude it, to make the following test:

The three *Stegomyia* referred to were placed in separate cages and given a fluid composed of rabbit serum, sugar, and water, and containing in suspension a grass bacillus, which in size and acid fastness closely resembled the bacillus of leprosy. Of these insects two

refused to feed, the third lit near the margin of the fluid and twice dipped the end of its proboscis into it, exhibiting the corkscrew motions of its abdomen that indicated that the insect was feeding.

One hour after this act the insect was killed with chloroform and removed from its cage, its body was washed and the abdomen separated from its thorax and its abdominal contents smeared upon a slide and stained by the method above described. Examination showed a considerable number of typical acid-fast bacilli in its intestinal contents, 45 being counted in seven fields; no other bacteria were demonstrated by the methylene blue counter stain. The experiment is to be repeated with lepra bacilli, and will appear in a future publication.

Search for the Bacillus of Leprosy in Blood-Filled Mosquitoes that Probably Had Fed upon Lepers.

We secured 34 blood-filled specimens of *Culex cubensis* caught on a screen door at the entrance to the Kalihi receiving station for lepers. In this compound there were about 20 lepers, showing nerve, tubercular, and mixed forms of the disease. Several healthy persons also resided in this compound. The screen door mentioned was a few yards from the patients' sleeping rooms, which were not protected by screening. These insects had probably fed upon some of these lepers, but on which cases, and therefore which type of the disease, was not ascertainable. The examination was made only because the insects were at hand and a possibility of securing positive results existed.

The results, however, were entirely negative, and therefore, owing to the uncertainty of the source of the blood, they are of only slight value.

Search for *Bacillus lepræ* in Blood-Filled *Culex cubensis* That Had Fed upon Lepers.

These insects were captured early each morning from the rooms of lepers; some of these rooms were occupied by one and some by two lepers; the condition of the occupant or occupants of each room is described below. The letters given the rooms are our own, and are for purposes of designation and convenience.

The probability of any of these insects having fed upon nonleprous persons is too slight to be considered. The probability of any appreciable percentage of them having fed upon lepers, not occupants of the room and therefore not those described, is very small.

Rooms and Brief Description of the Cases Occupying Each.

Room A: Occupied by two lepers, one a purely nerve case, the other showing general leprous infiltration over a large portion of the face.

Room B: Occupied by one leper. Large nodules about ears and a few small ones on face.

Room C: Occupied by one leper, showing numerous small papules and nodules scattered over face.

Room D: Occupied by one leper, showing diffuse infiltration of lobule of one ear and numerous small nodules scattered over the face.

Room E: Occupied by two lepers, both advanced cases, showing nodules and infiltration over a large part of their faces.

Room F: Occupied by two lepers, one showing small nodules scattered over face and some diffuse infiltration, the other case showing extensive leprous infiltration and nodules scattered over a large part of the face.

Room G: Occupied by one case, showing diffuse infiltration about malar regions and lobules of the ears.

Room H: Occupied by one case, showing infiltration of lobules of both ears, no other lesions on face.

Room I: Occupied by one case, showing nodules scattered over face, with inner one-third of face showing general infiltration.

The following table is self-explanatory; all the preparations and examinations were made by the method previously described. All the insects referred to in this table were blood-filled female specimens of *Culex cubensis*. The smear was made from thirty minutes to three hours after the capture of the insect.

Designation of room.	Number of cases.	Type of cases.	Number of mosquitoes procured from this room and examined.	Result of the examination of these insects.
A	1	Nerve case	108	No acid-fast bacilli found.
	1	Tubercular		
B	1	do	68	Do.
C	1	do	71	Do.
D	1	do	100	Do.
E	2	do	17	Do.
F	2	do	95	Do.
G	1	do	2	Do.
H	1	do	14	Do.
I	1	do	18	Do.

Tubercular cases exposed to mosquitoes	11
Blood-filled mosquitoes examined	493
Acid-fast bacilli found	0

DISCUSSION.

The failure to find bacilli in the insects may be supposed to be due to one or more of the following causes:

First. The cases were not suitable ones for the test.

Second. By chance the insect failed to bite over a nodule.

Third. The insect when at liberty purposely avoids nodules and chooses the areas of healthy skin.

Fourth. For some reason (as previously mentioned by Ehlers and Bourret) the mosquito does not take in bacilli when it feeds from the blood of leprous nodules.

Fifth. That the bacilli are soon destroyed in a mosquito's stomach.

As to the first of these reasons, the cases were all of the nodular type except one, and were average cases of the middle period of the disease; i. e., most of them would neither be called "very early" nor "advanced" cases.

As to the second point it is believed that the number of the insects examined excludes, on the face of it, such a supposition.

As to the third it appears quite improbable, as we know nothing analogous to it in the mosquito's feeding habits; this point is to be investigated in our future work.

As to the fourth supposition, this appears to most easily explain our results, and is borne out by the observations of two previous investigators; this is also to be investigated.

As to the fifth, the single experiment was so strikingly positive that this supposition is considered most improbable, but will be repeated with lepra bacilli.

To return to the first supposition, this raises a somewhat different question, which, so far as we know, no one has attempted to investigate, and in fact its investigation would be next to impossible; that is, whether a mosquito feeding upon a leper at the time of the existence of a bacillæmia (during the last stages of the disease) would not at times imbibe the organism.

None of our cases were advanced enough to lead one to suspect that a bacillæmia existed. That such a condition does occur at times is fully testified to, but the relatively small number of bacilli present even in such cases is also shown by the persons that have sought for it in vain. These two facts, the rarity of leprous bacillæmia and the relatively small number of bacilli present per unit of blood, are sufficient to exclude, on mathematical grounds, such an occurrence as being of epidemiological importance.

CONCLUSIONS.

Mosquitoes feeding, under natural conditions, upon cases of nodular leprosy so rarely, if ever, imbibe the lepra bacillus that we can exclude them as one of the ordinary means of transferrence of this bacillus from lepers to the skin of healthy persons. This insect is therefore not of epidemiological importance in this disease.

I desire to acknowledge the aid furnished me by Messrs. Fulloway and Terry, United States Department of Agriculture, in informing me as to the species name of the *Culex* found in Honolulu.

PART II.—A FURTHER NOTE ON THE FAILURE TO FIND LEPRA BACILLI IN MOSQUITOES THAT HAD FED UPON LEPERS.

In the previous paper[a] we published the negative results obtained by us from the examination of 493 female mosquitoes that had fed under natural conditions on cases of nodular leprosy. In that paper we stated that we expected to pursue these studies further as soon as female specimens of *Stegomyia callopus* could be obtained.

The examination referred to of the 493 mosquitoes demonstrated only that these insects, when feeding under natural conditions, did not contain lepra bacilli in their digestive tracts after such feeding. The present work was undertaken in hope of ascertaining the reason or reasons underlying the above fact.

In the first article we stated that one of the following reasons must account for the absence of the bacilli in these insects after such feeding:

First. That the cases of leprosy were not suitable ones for the test

Second. That by chance the insects had failed to bite over a leprous nodule.

Third. That the insect, when at liberty, purposely avoids nodules, and chooses the area of healthy skin.

Fourth. That for some reason, as previously mentioned by Ehlers and Bourret, the mosquito does not take in the bacilli when feeding from a leprous nodule.

Fifth. That the bacilli are soon destroyed in the mosquito's stomach.

The first of these we excluded by a description of the cases, which were of a type that afforded the mosquitoes every opportunity to obtain bacilli; the question of chance in the second supposition could be excluded on the face of it by the large number of insects examined. The remaining three we hoped to clear up in the experiments to be described in these notes.

LITERATURE.

In our first article on this subject we reviewed the literature, so shall not consider it here, except to state that in the former article we omitted to mention the negative results of the British commission to India for the study of leprosy (1890–1893).[b] In their experiments with a number of mosquitoes that had fed on lepers they report failure to find bacilli in thirty smears that they examined;

[a] Mosquitoes in relation to the transmission of leprosy, Part I.

[b] Report reviewed by Lancet, 1893, vol. 1, p. 1153, and Baumgarten's Jahresbericht, vol. 9, p. 273.

also an article by Ch. Nicolas, entitled "Moustiques et Lepre,"[a] in which the author, by reasoning from epidemiological data, believes the mosquito to play a part in the spread of leprosy.

We desire also to invite attention to the reference made to Ehlers's report on the results of the Danish-French commission (1909). The results of our experiments coincide with theirs, in so far as mosquitoes are concerned, and the conclusions drawn as to the probable explanation of the failure of this insect to imbibe the bacilli are identical with theirs, although we arrived at these conclusions in a somewhat different manner.

EXPERIMENTS.

A. To determine whether or not mosquitoes, when imbibing a fluid containing lepra bacilli, will not only take in these bacilli, but will retain them, morphologically unchanged, in its digestive tracts for a reasonable length of time.

Experiment 1.—Placed 14 of these insects in a jar and gave them a suspension of lepra bacilli in water. Withdrew all other fluid to force them to imbibe of this suspension. At the end of twenty-four hours we killed the insects with chloroform. There was no way of determining which of these insects, if any, had imbibed this fluid except by the presence of lepra bacilli in their digestive tracts.

Smeared the abdominal contents of these insects on glass slides, fixed them by heat, stained them for three minutes in Carbo-Fuchsin (Ziehl-Nielson), decolorized for ten seconds in 1 per cent nitric acid in 70 per cent alcohol, counter stained with Loeffler's Methylene Blue, and examined these stained smears under the oil immersion lens.

9 of these insects showed no bacteria of any kind in their intestinal tracts.
5 of these insects showed a large number of lepra bacilli in their intestinal tracts.

These organisms were typical and unchanged in appearance, even to the occurrence in characteristic clumps, the largest of these clumps containing 10 lepra bacilli. Many oil immersion fields showed 20 or more lepra bacilli, although the smears were of only average thickness.

Experiment 2.—Placed 6 of these insects in a cage containing a similar lepra bacilli suspension in water.

Twenty-four hours later we killed these insects with chloroform, smeared their intestinal contents on glass slides, and stained them by the method described in the last experiment:

4 of these insects showed no bacteria of any kind in their intestinal contents.
2 of these insects showed numerous typical lepra bacilli in their intestinal contents.

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[a] Bull. Soc. pathol. exot., 1908, p. 493, quoted by Lepra, vol. 8, fasc. 4, p. 243.

B. Experiments having a twofold object:[a]

First. To ascertain whether the female *Stegomyia callopus* shows any preference between the normal skin and the skin over leprous nodules.

Second. To ascertain whether mosquitoes which had actually fed over a leprous nodule did or did not contain lepra bacilli in their digestive tracts.

Experiment 1.—Placed 5 female specimens of *Stegomyia callopus* in a large-mouth bottle and placed the bottle over a leprous nodule; 3 insects bit the adjacent normal skin, while 2 bit over the nodule. Two hours later all 5 insects were killed with chloroform and their abdominal contents stained and examined. None of these insects showed any acid-fast bacilli in their digestive tracts. Of course it was not to be expected that the 3 that bit the normal skin would contain such bacilli, but they were all examined as a matter of routine.

Experiment 2.—Placed 3 female specimens of *Stegomyia callopus* over a leprous nodule, by the same method described above. They all lit on the normal skin, but refused to feed, probably due to the fact that the atmospheric temperature was low, and the room in which the experiment was performed was not well lighted.

Experiment 3.—Placed 7 female specimens of *Stegomyia callopus* over a leprous nodule; 5 refused to bite, 1 bit the normal skin, and 1 bit over the leprous nodule. Examination of the 2 insects that had fed failed to show any acid-fast bacilli.

Experiment 4.—Placed 9 female specimens of *Stegomyia callopus* over a leprous nodule; 3 bit the normal skin and 6 refused to bite at all. Examination of the 3 insects which had bitten the normal skin was, as would be expected, negative.

Experiment 5.—Placed 2 female specimens of *Stegomyia callopus* over a leprous nodule; both bit the normal skin.

Experiment 6.—Placed 1 female specimen of *Stegomyia callopus* over a leprous nodule; insect bit the normal skin.

Experiment 7.—Placed 4 female specimens of *Stegomyia callopus* over a leprous nodule; 3 bit the normal skin and 1 bit over the nodule. Examination of all 4 insects showed no acid-fast bacilli in their intestinal tracts.

Experiment 8.—Placed 4 female specimens of *Stegomyia callopus* over a leprous nodule; 2 bit the nodule and 2 bit the normal skin. Examination of the 4 insects gave negative results as to acid-fast bacilli.

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[a] In all these experiments the leprous nodules were rather small, not occupying more than one-third of the total skin area surrounded by the mouth of the bottle, so that on an average the mathematical chances of the insect biting a nodule was as 1 is to 2 of its biting the normal skin.

Experiment 9.—Placed 1 female specimen of *Stegomyia callopus* over a leprous nodule; it bit the skin over the nodule. Examination of the insect failed to show any acid-fast bacilli in its intestinal tract.

Experiment 10.—Placed 1 female specimen of *Stegomyia callopus* over a leprous nodule. In biting, the insect chose the adjoining normal skin instead of the nodule. After a two hours' interval we smeared the abdominal contents of this insect and examined it, with negative results.

It will be seen by the experiments so far recorded that of 37 mosquitoes placed over leprous nodules 7 bit the nodules, 16 bit the normal skin, and 14 refused to bite.

C. Having thus obtained sufficient data to indicate that the insect exhibited no preference for either normal skin or leprous nodule, we ceased to keep account of those insects which fed on normal skin or those insects which refused to bite at all, the recorded experiments from here on bearing only on those insects which actually punctured a well-marked leprous nodule.

Experiment 1.—Placed a number of female specimens of *Stegomyia callopus*, each in a separate bottle, over a leprous nodule; of these, 5 bit a leprous nodule. Examination of these 5 insects showed no lepra bacilli in their digestive tracts.

Experiment 2.—Placed 1 female specimen of *Stegomyia scutellaris* over a leprous nodule; the insect bit the skin over the nodule. Examination of the insect showed no lepra bacilli in its digestive tract.

Experiment 3.—Placed a number of female specimens of *Stegomyia callopus*, each in a separate bottle, over a leprous nodule; of these, 2 bit the skin over the leprous nodule. Examination of these insects showed no lepra bacilli in their digestive tracts.

Experiment 4.—Placed a number of female specimens of *Stegomyia callopus*, each in a separate bottle, over a leprous nodule; of these, 9 bit the skin over a leprous nodule. Examination of these 9 insects showed no lepra bacilli in their digestive tracts.

Experiment 5.—Placed a number of female specimens of *Stegomyia callopus*, each in a separate bottle, over a leprous nodule; of these, 7 bit the skin over a leprous nodule. Examination of these 7 insects showed no lepra bacilli in their digestive tracts.

Experiment 6.—Placed a number of female specimens of *Stegomyia callopus*, each in a separate bottle, over a leprous nodule; of these, 15 bit the skin over a leprous nodule. Examination of these 15 insects showed no lepra bacilli in their digestive tracts.

Experiment 7.—Placed a number of female specimens of *Stegomyia callopus*, each in a separate bottle, over a leprous nodule; of these, 8 bit the skin over a leprous nodule. Examination of these 8 insects showed no lepra bacilli in their digestive tracts.

Experiment 8.—Placed a number of female specimens of *Stegomyia callopus*, each in a separate bottle, over a leprous nodule; of these, 6 bit the skin over a leprous nodule. Examination of these 6 insects showed no lepra bacilli in their digestive tracts.

Experiment 9.—Placed a number of female specimens of *Stegomyia callopus*, each in a separate bottle, over a leprous nodule; of these, 7 bit the skin over a leprous nodule. Examination of these 7 insects showed no lepra bacilli in their digestive tracts.

SUMMARY.

1. Of 23 insects that were given a choice of feeding on the skin over a leprous nodule or on normal skin, 7 bit over the nodules and 16 bit the normal skin. The area covered by the nodules and the area covered by the normal skin was as 1 is to 2.
2. Total number of insects that bit leprous nodules (B plus C series), 67.
3. Number of insects that showed lepra bacilli, none.
4. Of 20 mosquitoes given an opportunity to feed on a suspension of lepra bacilli in water, 7 showed lepra bacilli and 13 showed no lepra bacilli in their digestive tracts.

DISCUSSION.

First. That if mosquitoes should imbibe any body fluid that contains lepra bacilli, they will not only take those bacilli into their digestive tracts, but will keep them there, morphologically unchanged, for several hours.

Second. That the mosquito, when it bites over a lepra-bacilli-filled nodule, does not imbibe the bacilli.

Third. That when given its choice the insect appears to show no preference for either the normal skin or a nodule.

If the first and second of these three observations are correct, then it follows that the insect, when it punctures the skin over a leprous nodule, draws only bacilli-free fluid, this alone accounting for the absence of bacilli in its body after such feeding. The investigator, in attempting to imitate the insect by puncture, invariably draws a bacilli-filled fluid. The fluid of a nodule that is rich in bacilli is the lymph. The only bacilli-free fluid that a nodule could contain is that within the vessel walls of the general circulation (capillary or small venule).

From this reasoning, based upon the data obtained in the experiments cited above, it is evident that, while it is impractical for man to obtain lymph-free blood through a puncture of the skin, this insect is able to, and does, insert its proboscis directly into a capillary or other small vessel and draws pure blood directly from the general circulation.

In these experiments, as in those described in the first paper, we are dealing with cases of the afebrile stage of leprosy. Our experiments, therefore, present no data as to what may occur during the febrile stage of the disease, in which bacillæmia is present. But, as stated in the foregoing paper, the stage of bacillæmia is relatively rare, and the number of bacilli per unit of blood is relatively small; even though the mosquito does imbibe bacilli in such febrile cases, it must occur too seldom to be of great epidemiological importance.

CONCLUSIONS.

First. The reason that mosquitoes that have fed on lepers do not contain the lepra bacilli is that when these insects feed they insert their proboscis directly into a blood vessel and thus obtain bacilli-free blood, unmixed with lymph.

Second. That the above-mentioned habit alone accounts for the absence of lepra bacilli in mosquitoes that have fed on lepers; the insect neither avoids biting a leprous nodule nor is its digestive tract or the contained fluids capable of altering the morphology of this bacillus in a reasonable length of time.

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FLIES IN RELATION TO THE TRANSMISSION OF LEPROSY.

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INTRODUCTION.

Practical experience has demonstrated that in some countries leprosy can be controlled by sanitary regulations, including the isolation of the afflicted. But the fact remains that there are other localities where no amount of effort can remove the passive resistance of a large part of the population to such measures. Such resistance need consist in little more than the refusal to report their sick to the authorities in order to make the eradication of the disease next to impossible.

In its early stages, sometimes for the first few years of the disease, the symptoms are often such as to make this concealment an easy matter. In spite of this difficulty, all possible efforts should be directed to the early detection and isolation of cases, but if we could determine more exactly the means by which leprosy is spread we might expect to develop, from the knowledge thus gained, other sanitary regulations that would tend to inhibit some of the mechanisms of transfer, and thus aid the present system of isolation in the control of the disease.

See's abstract of Jeanselme's article [a] contains the following three terse sentences: "La lèpre est une maladie terrible et incurable." "La race blanche n'est pas à l'abri de la lèpre." "La lèpre se propage exclusivement par contagion." [b] These words express much—our helplessness after the disease has developed, the danger to which no people are immune, and the measures that offer the greatest chances of success, the measures looking to the prevention of contagion, direct or indirect.

[a] Lepra, Vol. III, p. 64.

[b] The author employs "contagion" in a broad sense as meaning direct or indirect contact, as is shown further on in the article by the following: " ......de toutes les professions amenant avec d'autres individus des contacts directs ou indirects (alimentation, habillement, domesticité, etc.) de l'usage des bains, hôtels, voitures publiques, etc."

But in order to carry out these measures more perfectly we must first know what constitutes indirect contact—what agencies constitute a mechanism for the transfer of the infection.

In our present state of knowledge all that we can *hope* to prove is that a certain mechanism does or does not convey the organism to the skin or mucosa of man. If we can show that a certain mechanism does not effect such transfer, we can exclude it as a factor in the spread of the disease. If, on the other hand, we can show that a certain mechanism often does convey the bacillus of leprosy from the ulcers of lepers to the skin of healthy men, we are justified, in the interests of sanitary protection, in presuming that such a mechanism is a factor in the spread of the disease. Until we have grown the bacillus on artificial media, and successfully inoculated the lower animals with such cultures, it is difficult to see how we can hope to progress beyond this stage of presumptive evidence.

LITERATURE.

The following literature has been referred to and has a direct bearing on this subject:

Report of the Leprosy Commission in India. (Lancet, May 13, 1893, p. 1153; also Baumgarten's Jahresbericht, vol. 9, p. 269.) This commission placed 10 flies on leprous ulcers, the secretions of which were rich in bacilli. The subsequent examination of these flies showed no lepra bacilli.

Corredor, 1893 (Revista Méd. de Bogotá, No. 201, and reviewed by Polakowsky in Deutsche med. Wochenschrift, No. 40, p. 646; also referred to by Nuttall (1899) in Johns Hopkins Hospital Reports, Vol. VIII), speaks of the statement of an Indian living with lepers that flies often gathered upon the ulcers of these afflicted persons, after which the insects bit him; that the site of such bites became inflamed and later ulcerated, and that from these leprosy resulted.

Nuttall, 1899, in his masterly article entitled "On the rôle of insects, arachnids, and myriapods as carriers in the spread of bacterial and parasitic diseases of man and animals" (Johns Hopkins Hospital Reports, Vol. VIII), states "it appears that Linnæus and Rolander considered that *Chlorops* (*Musca*) *lepræ* was able to cause leprosy by its bite" (Blanchard, Zool. med. II, p. 497). Nuttall also reviews this subject up to date, referring to Corredor, and quotes Joly (1898), "Importance du rôle des insectes dans la transmission des maladies infectieuses et parasitaires," as stating that Sabrazes believed that leprosy might be transferred by a large number of small inoculations from insects.

Joly, 1901 (Lèpre à Madagascar. Arch. de Méd., Nov., 1901, p. 459, and referred to in Lepra, vol. 3, p. 57), believes flies fill themselves with the secretions of lepers and carry the bacilli to others.

Tucker, 1903. A contribution to the discussion on the ætiology of lepra. (Indian Lancet, 1903, vol. 21, p. 830.) Baumgarten refers to this article in Baumgarten's Jahresbericht, vol. 19, p. 335, as follows: "Believes certain fly plays a rôle in spread of leprosy, but furnishes no proof."

Smit, 1906 (Arch. f. Dermatol. u. Syphil., vol. 91, p. 389), in writing of leprosy in the Argentine, states that he does not believe in insect transmission.

Miser, 1906, in an article entitled "Prophylaxie des maladies exotiques" (quoted in Baumgarten's Jahresbericht, vol. 22, p. 343), refers to Corredor's statement (vide supra).

Clift, 1907, in an article entitled "The intestinal origin of leprosy" (British Med. Journ., Apr. 20, 1907, p. 931; also Arch. f. Dermatol. u. Syphil., vol. 89, p. 132), raises the question of the possible transfer of lepra bacilli by means of flies from leprous ulcers to foodstuffs.

Wherry, 1908, in an article entitled "Further notes on rat leprosy and on the fate of human and rat lepra bacilli in flies" (Journ. of Inf. Diseases, vol. 5, p. 507; also U. S. P. H. and M. H. Reports, vol. 23, p. 1841), shows by experiment that several flies, including *Musca domestica*, took up large numbers of rat-lepra bacilli from the carcass of a leprous rat and deposited them all in a few days after ingestion. That the larvæ of *Calliphora vomitoria* if placed in the carcass of a leprous rat become heavily infected with lepra bacilli, but the flies produced by these larvæ seldom contain the bacilli, and then only a few. He also states that a single fly (*Musca domestica*) caught on the face of a human leper showed numerous acid-fast lepra-like bacilli.

Nash, 1909, in an article entitled "House flies" (Journ. of Hyg., vol. 9, p. 161), states "the spread of leprosy has also been attributed to biting flies."

Duque, 1909 (Sanidad y Beneficencia, Habana, June, 1909), expresses the belief that flies act as carriers of leprosy.

MacLeod, 1909 (The present state of our knowledge of the bacteriology and pathological anatomy of leprosy. Lancet, Aug. 21, 1909), states: "So far the microbe has not been found in insects suspected of disseminating the disease."

Muhlens, 1910 (Berliner Klin. Wochenschrift, Mar. 7, 1910, p. 440), refers to Wherry's work as follows: "Wherry has established the fact that lepra bacilli taken up by flies do not multiply in the latter, and are soon deposited again."

The close resemblance of the tubercle and lepra bacill make data obtained in the case of the one of a certain value in the case of the other. Therefore the following references are not out of place:

Spillmann and Haushalter, 1887 (Dissémination du bacille de la tuberculose par mouches. Compt. rend., vol. 7, p. 352), found many tubercle bacilli in the bodies and in the feces of flies that they had captured in the wards of a hospital.

Hofmann, 1888. Ueber die Verbreitung der Tuberkulose durch Stubenfliegen. Correspondenzblatt d. aertzl. Kreis- u. Bezirksvereine im Koenigreiche Sachsen, vol. 44, No. 12, p. 130, referred to by Nuttal. Found tubercle bacilli in 4 out of 6 flies caught in a ward which had been occupied by a patient suffering from tuberculosis.

Lord, 1904. Boston Med. & Surg. Journ., December 15, 1904, pp. 651-654. Publ. of Mass. Gen. Hosp., 1906, p. 118, and reviewed by Lancet, February 18, 1905, and by the Journal of American Medical Assn., March 31, 1906. Also referred to by Wherry in his article (for title, etc., vide supra), and by Howard in Bull. No. 18, U. S. Dept. of Agriculture. We have not seen the original publication, but from the several reviews and references it appears that Lord fed 30 caged flies with tuberculous sputum. During the next few days these insects deposited many tubercle bacilli (3,000 to 5,000 per speck), and by the end of the third day 26 of these 30 insects had died. Some of the references to this article mention the experiment as demonstrating that the bacilli increased in the insects' intestinal tract; that immense numbers were deposited is certain, but there is nothing in the references we have that speaks of the numbers ingested. That the tubercle bacillus should multiply greatly in three days under such conditions of temperature, etc., would seem most surprising.

Heiser, 1909 (Quarterly Report of Bureau of Health for the Philippine Islands, third quarter, 1909, p. 3), states that "the bacilli of tuberculosis may also be disseminated by flies, because the fly will feed on sputum, and the tubercle bacilli may pass through the digestive tract alive and appear in the flyspeck. Tubercle bacilli have been found alive in the excreta of flies fed with infected sputum fifteen days after the flyspecks had been deposited."

The following literature has also been referred to; it has only an indirect bearing on the subject:

Hirch, 1896. An account of two cases of coko or framboesia. Lancet, Vol. II, p. 173.

Howard, 1902 (Farmers' Bull. 155, U. S. Dept. of Agriculture), speaks of the immense productive power of the "house fly."

Nash, 1904 (Lancet, vol 1, p. 380), speaks of flies as transmitters of various epidemic summer diarrheas.

Chantemesse and Borrel, 1905 (Report of the Meeting of the Acad. of Med., of Paris, Lancet, Nov. 4, 1905, p. 1368), speak of flies in connection with the spread of cholera.

Howard, 1906 (Circular 71, U. S. Dept. of Agriculture), speaks of the several kinds of flies found about dwellings.

Newstead, 1907 (Ann. of Trop. Med. and Parasit., p. 507), speaks of the several kinds of flies found in dwellings.

Stephens and Newstead, 1908. The anatomy of the proboscis of biting flies. (Ann. of Trop. Med. and Parasit., 1907, vol. 8, p. 171.)

Glover, 1908 (Lancet, Sept. 5, 1908, p. 715), speaks of flies as carriers of infantile diarrhea.

Newstead, Dutton, and Todd, 1908 (Ann. of Trop. Med. and Parasit., vol. 1, p. 3), speak of biting flies in the Congo Free State.

Esten and Mason, 1908 (Storrs Agri. Exper. Station, Bull. 51, quoted by Howard in Bull. 78, U. S. Dept. of Agriculture), state that of 414 flies examined the average number of bacteria was over 1,000,000 per fly.

Huber, 1908 (N. Y. State Journ. of Med., Nov., 1908), states that he believes tubercle bacilli are often carried by flies.

No attempt has been made to cover the literature on the subject of flies in connection with diseases other than lepra, the above few being cited only as examples of the well-known habit of the fly of conveying certain pathogenic organisms.

The interest in and knowledge bearing on insects as disease carriers are, for the most part, quite recent; but the following is of interest as denoting that opinions on this subject were held by some at an early date: Netter (Arch. de Méd. Expérim., 1900, p. 109) quotes the following paragraph:

Imo muscas tam infirmorum tam cadaverum succo saturates mox in alias domos vincinales transmigrantes, dum sordibus suis comestibilia inficiunt, hominibus attulisse Mercurialis refert.

Nobilis quidam in nupera peste Neapolitanea cum nescio quid ad fenestram observaret ecce crabro quidam advolans naso insedit et promuscidis spiculo eidem infixo tumorem quemdam effecit quo sensim crescente et intra viscera serpente veneno intra biduum (haud dubie ex contagioso humore quem musca ex cadavere susceperat) contracta peste extinctus fuit.

SUMMARY OF LITERATURE.

Aside from those who apparently hold opinions based upon theoretical grounds, we have the following research work:

1. The commission to India, 1893. They placed 10 flies on the ulcers of lepers, the contents of which were rich in bacilli, but their results were negative.

2. Wherry, who examined a single fly caught from a human leper, found lepra bacilli in its intestinal contents.

In addition to the above, we have the report of Corredor; but it will be seen that the observation was not made by Corredor, but by an Indian leper, and from our information, we presume, an untrained observer. We hardly think that this observation should be given much weight.

Attention is invited in this connection to the fact that we are dealing with nonbiting flies; if it were otherwise, a little more literature could be cited, notably the Danish-French commission.

When we consider the interest recently shown in the subject of insects as disease carriers, the small amount of published researches on the subject we are dealing with is surprising. Especially is this true when we further consider that leprosy is known to occur most where social and hygienic conditions are not good. It is under such conditions as these that we are apt to find the bacilli-discharging ulcer carelessly exposed to the attacks of flies, and it is also under such surroundings that these insects are apt to be in greatest abundance.

FLIES EXPERIMENTED WITH.

Of the several species of flies found in Honolulu and Kalawao, we chose the following for our experiments: *Musca domestica*, *Sarcophaga pallinervis* (*Thomson*), *Sarcophaga barbata* (*Thomson*), *Volucella obesa* (*Fabr.*), and an undetermined species of *Lucilia*.[a]

As might be expected, we found that in and about dwellings the first-named fly is by far the more numerous; in fact, greatly exceeds in number all other kinds of dipterous insects combined. The findings in the case of this fly may, therefore, be of greater importance from a sanitary standpoint than the findings in the cases of the two kinds of *Sarcophaga* (the common blowfly in this locality). The *Lucilia* (species undetermined) is fairly common; the *Volucella obesa* could hardly be of importance, for the reason that, although occasionally found in houses, I have never seen it voluntarily light on man, and it is more often found in shaded parts of the premises, outside of the dwellings.

CONTROL WORK.

Twenty specimens of *Musca domestica* and 12 specimens each of the four other varieties were captured and killed with chloroform; their abdomens were detached and opened, the intestines removed, and their contents smeared on glass slides and fixed, after which they were stained with carbo-fuchsin (Ziehl-Nielson). They were then decolor-

[a] We are indebted to Messrs. Fullaway and Terry, entomologists, Hawaii Experimental Station, U. S. Department of Agriculture, for the classification of the above-mentioned flies.

FLIES IN RELATION TO THE TRANSMISSION OF LEPROSY.

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INTRODUCTION.

Practical experience has demonstrated that in some countries leprosy can be controlled by sanitary regulations, including the isolation of the afflicted. But the fact remains that there are other localities where no amount of effort can remove the passive resistance of a large part of the population to such measures. Such resistance need consist in little more than the refusal to report their sick to the authorities in order to make the eradication of the disease next to impossible.

In its early stages, sometimes for the first few years of the disease, the symptoms are often such as to make this concealment an easy matter. In spite of this difficulty, all possible efforts should be directed to the early detection and isolation of cases, but if we could determine more exactly the means by which leprosy is spread we might expect to develop, from the knowledge thus gained, other sanitary regulations that would tend to inhibit some of the mechanisms of transfer, and thus aid the present system of isolation in the control of the disease.

See's abstract of Jeanselme's article [a] contains the following three terse sentences: "La lèpre est une maladie terrible et incurable." "La race blanche n'est pas à l'abri de la lèpre." "La lèpre se propage exclusivement par contagion."[b] These words express much—our helplessness after the disease has developed, the danger to which no people are immune, and the measures that offer the greatest chances of success, the measures looking to the prevention of contagion, direct or indirect.

[a] Lepra, Vol. III, p. 64.

[b] The author employs "contagion" in a broad sense as meaning direct or indirect contact, as is shown further on in the article by the following: " ......de toutes les professions amenant avec d'autres individus des contacts directs ou indirects (alimentation, habillement, domesticité, etc.) de l'usage des bains, hôtels, voitures publiques, etc."

On the day following, i. e., forty-eight hours from feeding, the feces of the insect (that has been passed between the twenty-fourth and forty-eighth hour after the feeding) were again examined, but no acid-fast bacilli were found. On the same day the insect was killed with chloroform and its intestinal contents examined, but no acid-fast bacilli were found.

Experiments with *Sarcophaga barbata*.

Experiment 1.—A specimen of this species was placed over a grass-bacilli infected ulcer. The insect lit on edge of ulcer and deposited six larvæ. These larvæ entered the ulcer and buried themselves in its secretions. The adult insect did not feed herself; she was removed into a clean cage, where she deposited a large number of larvæ. The larvæ which were deposited on the ulcer's edge were labeled "4–A," while those subsequently deposited in the cage were labeled "4–B," and will be referred to later. Inasmuch as the adult insect did not feed, she was destroyed.

Experiment 2.—Another specimen of this species was chosen and placed over a grass bacilli-infected ulcer. She lit near the edge of the ulcer, and fed from it for a short interval. She deposited no larvæ.

The following morning the adult insect was found dead in the cage. Examination of her intestinal contents showed several hundred acid-fast bacilli to each oil immersion field.

Experiment 3.—Another specimen was placed over an infected ulcer. She fed very little from it, but deposited a number of maggots. These maggots buried themselves in the secretions of the ulcer; after being allowed to remain there, they were placed in a clean cage and labeled "12–A," and will be referred to later. The adult insect died during the following night. Smears from its intestinal contents showed no acid-fast bacilli.

Experiment 4.—Another fly of this species was chosen and placed over a similarly infected ulcer. The insect fed, but did not deposit larvæ; it was placed in a clean cage and given food, as in the case of the previously mentioned insects. This insect invariably deposited her feces on the foodstuffs she was furnished, so that no specks for examination were obtainable. The insect died seven days after feeding. The intestinal contents showed no acid-fast bacilli.

Experiment 5.—Another fly of the same species was placed over a similarly infected ulcer. It fed, but did not deposit larvæ. The insect was given a clean cage and food.

No feces from this insect were examined for the first twenty-four hours. Those deposited two days later were examined and found to be negative. The insect was then chloroformed, but no acid-fast bacilli were discovered in its intestinal contents.

Experiments with *Lucilia* (species undetermined).

Experiment 1.—A specimen of this species was chosen and placed over an ulcer infected with grass bacilli. It at once lit upon the ulcer, walked over its surface, and fed freely from its secretions.

The following morning the insect was found dead; examination showed a moderate number of acid-fast bacilli in its intestinal contents.

Experiment 2.—Another fly of this species was placed over an ulcer in the same manner as in the previous experiment. The insect lit by ulcer and walked across its surface, but it was not possible to determine whether it had fed or not.

The following morning the insect was found dead. Examination of its intestinal contents showed no acid-fast bacilli.

Experiments with *Volucella obesa* (Fabr.).

Experiment 1.—Placed a specimen of this species of insect over an infected ulcer. It refused to go near the ulcer.

Experiment 2.—Placed a specimen of the same insect over an infected ulcer. The insect went to the ulcer at once and fed from its secretions, but did not deposit larvæ.

On the following day the feces of this insect were examined and found to contain an average of 7 or 8 acid-fast bacilli per oil-immersion field. No further examination was made until the third day (four days from the time of feeding), when the insect was found dead. Its intestinal contents were examined, but no acid-fast bacilli were found.

Experiment 3.—Another fly of this species was chosen. It lit upon the ulcer, fed freely, and deposited three larvæ. These larvæ were labeled "21-A," and will be referred to later.

Second day: The adult insect was given a clean cage and food.

Third day: Its feces were examined and showed an average of 55 acid-fast bacilli to each oil-immersion field.

Fourth day: Examination of the feces of this insect showed 18 acid-fast bacilli per oil-immersion field.

Fifth day: Examination was made of the feces of this insect and showed an average of 12 acid-fast bacilli to each microscopic field.

Sixth day: Feces of this insect were found to contain an average of between 3 and 4 acid-fast bacilli per field.

Seventh day: The search of the feces showed an average of a little more than 1 acid-fast bacillus to each oil-immersion field.

As the acid-fast bacilli had been reduced to such small numbers on this day, no further examinations of the feces were made.

Experiments with House Flies (*Musca domestica*), That Were Fed with Grass Bacilli.

Experiment 1.—First day: Placed 50 house flies (*Musca domestica*) in a large glass jar, covered the latter with cheese cloth, and fed the insects agar-culture of grass bacilli, suspended in bouillon containing sugar.

Second day: Withdrew the bouillon containing the grass bacilli, and fed the insects peptone bouillon containing sugar, but no grass bacilli. (For the sake of brevity we state here that this sterile food was renewed daily throughout the life of the insects, no more acid-fast bacilli being given them).

Third day: Several flies found dead in cage; examined them and found that their intestinal contents showed from 35 to 50 acid-fast bacilli per oil-immersion field. Thirteen specks were examined, these being deposited from the time of the withdrawal of the food to the twenty-fourth hour thereafter—i.e., forty-eight hours from the earliest possible time that the insect could have fed on the acid-fast organisms and twenty-four hours from the last opportunity the insect had of imbibing the bacilli. Four of these were negative as to acid-fast organisms, the balance showing from 2 to 4 acid-fast bacilli per oil-immersion field. Later on the same day eight specks were taken from the jar and examined. Two of these specks showed no acid-fast bacilli, six showed from 25 to 40 acid-fast bacilli per oil-immersion field. Still later, on the evening of the same day, six more specks were examined. Four of these showed no acid-fast bacilli and two contained on an average 45 bacilli per microscopic field.

Fourth day: Thirty-eight specks were examined, and for the sake of convenience from these thirty-eight specks 19 specimens were made—i. e., each specimen stained for examination was composed of two flyspecks. Each one of these nineteen specks contained acid-fast bacilli, the number varying from 1 acid-fast bacillus to 23 acid-fast bacilli per field, the average being 6 acid-fast bacilli per field.

Fifth day: Eighteen flyspecks were chosen and examined. All showed acid-fast bacilli, from 1 to 8 per microscopic field.

Sixth day: Ten specimens of feces examined showed 3 acid-fast bacilli to the field, 14 specimens of feces showed no acid-fast bacilli, 10 specimens examined showed an average of 1 acid-fast bacillus to the field.

Seventh day: Nearly all insects dead. Four of the living ones were killed and their intestinal contents examined. No acid-fast bacilli were found; experiment closed.

Experiment 2.—Placed 49 flies in large cage and fed them with agar-culture of grass bacilli, suspended in bouillon containing sugar.

Second day: Withdrew the grass bacilli; from now on only feeding sterile sugar broth. Divided the insects into six groups and placed each group in a separate cage.

Third day: Killed first group composed of 5 flies (3 having died), smeared their intestinal contents on glass slides, and stained former. First fly showed an average of 1 acid-fast bacillus to two microscopical fields; second insect showed very few acid-fast bacilli, 1 to many fields; third insect showed an average of 80 acid-fast bacilli per microscopical field; fourth insect showed on an average 10 acid-fast bacilli to each field; fifth insect showed an average of 15 acid-fast bacilli per field.

Fourth day: Killed the second group, composed of 7 flies (1 having died). Three of these insects showed no acid-fast bacilli, 1 showed an average of 4 bacilli to each field, 1 showed an average of 10 bacilli to each field, 1 showed an average of 1 bacillus to four fields, and 1 showed 2 bacilli to each field.

Fifth day: Third group killed, composed of 8 flies. Five flies showed no acid-fast bacilli in their intestinal contents, 2 showed an average of 1 acid-fast bacillus to seven fields, and 1 showed an average of 12 bacilli to each field.

Sixth day: Fourth group killed, composed of 6 flies (2 having died). None of these insects showed any acid-fast bacilli.

The insects of the last two groups were destroyed, owing to the failure to discover any acid-fast bacilli in the fourth group.

The preliminary experiments with the grass bacillus show:

First. That certain "blowflies," when given an opportunity, will light upon an ulcer and imbibe of its contents; that by doing this it takes in the bacilli that are present in the secretions of the ulcer, and later frees itself of them by means of its intestinal discharges. While it is not possible with the few experiments we have performed to speak positively on the point, the impressions we gained in this preliminary work were that the bacilli probably did not increase nor were they destroyed in its intestinal tract, but that the number discharged approximated the number imbibed.

Second. That flies of certain species deposit larvæ in ulcers; in fact in some cases appear more anxious to do this than to feed themselves.

Third. That in the "house fly" (*Musca domestica*) we have an insect that will harbor these bacilli in its intestinal tract for several days after imbibing them.

House flies are very numerous in most localities, and while it is our intention to determine how long the bacilli remain in the intestinal tract, we feel that this is not the most important part of the subject, but rather how many bacilli they imbibe and discharge; for, given a constant source of supply, the number of times these insects will fill themselves with such organisms and later discharge them is probably limited only by the length of the insect's life.

Furthermore, its propensity for lighting upon ulcers exposed to its attacks is too well known to require laboratory data on the subject; it is also well known that the same insects light upon the skin and exposed mucus membrane of man, upon his food supply, and in addition to this deposit their feces in all conceivable places, and that such feces afterwards become dry and are blown about as "dust."

In regard to the larvæ above referred to, and designated as "2–A," "13–A," "17–A," "4–A," "12–A," "21–A," for the sake of brevity we shall not describe each of these experiments separately, as they all gave practically parallel results, and show that the larvæ of these insects, which had fed upon these acid-fast bacilli, contain immense numbers of the said bacilli immediately after such feeding. These bacilli, however, progressively decrease in numbers from the time of feeding up to the time the larvæ enters its pupa stage. At the time of this latter event there are nearly always a few acid-fast bacilli still present, but only a very small percentage of the number present on the day of the feeding.

These acid-fast bacilli, and in our experience other micro-organisms, completely disappear before the insect emerges as a fly. The larvæ can, therefore, not be considered as being of importance in the transmission of a bacillary disease; the rare accident of a larvæ as such reaching another human being is so small that we need not consider it.

In the case of larvæ designated as "4–B" (vide supra), we supplied them throughout their larvæ existence with muscle that had been infected with grass bacilli. They were, as would be expected, heavily infected with grass bacilli up to the time they entered the pupa stage, but emerged in the insect stage free from acid-fast bacilli.

That flies of this type do light upon the ulcers of lepers, and do deposit larvæ upon them, and that these larvæ remain for a number of days (and possibly reach the pupa stage) in such ulcers, are matters of clinical observation. Patients have been received at Kalihi whose leprous ulcers were infested with such larvæ. Even with this fact known to us, the manner in which bacteria disappear during the pupa stage so convinced us of the nonimportance of this phase of the subject that we made no attempts to duplicate the larvæ experiments in the work with the bacillus of leprosy, but confined our attention to the adult insect.

PART II.—THE BACILLUS OF LEPROSY.

EXAMINATION OF THE ULCERS OF LEPERS FOR LEPRA BACILLI.

We chose 20 ulcers on the bodies of 8 patients under our care; from each of these ulcers we made a smear and stained it in the usual manner. Fourteen of these ulcers contained lepra bacilli in abun-

dance, 3 of them contained a moderate number of lepra bacilli, and 3 contained no lepra bacilli.

It is hardly necessary to state that the ulcers we chose were those formed by the breaking down of leprous nodules, and not the neurotrophic ulcer.

Flies and Human Lepra Bacilli.

Experiment 1.—Twenty house flies (*Musca domestica*) were placed in a cheese-cloth covered jar; the insects were fed a broth suspension containing lepra bacilli, which were obtained from leprous ulcers; this suspension was not rich in bacilli, however, but it was the best we could obtain at the time.

In this cage, containing the 20 flies, we placed a number of glass slides in such a manner as to offer attractive roosting places for the insects, and so arranged them that the flies had access to only one side of each slide. The following day the flies were all found dead (cause of death unknown). We had intended withdrawing the leprous material at this time, but their premature death prevented us from carrying out this part of the experiment. They had, however, deposited 4 specks upon the slides before death. These were stained and examined, 2 of these showing a moderate number of lepra bacilli and the other 2 specks showing no lepra bacilli. Eight of these dead flies were chosen at random and their intestinal contents smeared and examined. Four of these showed no acid-fast bacilli of any kind, 4 showed a large number of acid-fast bacilli identical in appearance with the lepra bacilli, and often present in large clumps.

Experiment 2.—Placed 25 flies in a jar and fed them the scrapings from a leprous ulcer, diluted with normal saline solution and the yolk of an egg, this dilution being necessary on account of the small amount of the scrapings. The resulting suspension was far from being rich in lepra bacilli.

At the end of twenty-four hours many of the insects were dead. They were given fresh slides at that time, and the leprous material was removed from the cage, broth being given them instead.

Twenty-four hours after the withdrawal of this leprous material 16 flyspecks had been deposited on the glass slides. They were stained and examined, with the following results:

16 specks were examined.
4 specks showed no lepra bacilli.
11 specks showed lepra bacilli, usually in considerable numbers, two or three large clumps often being observed in a microscopical field.

Twenty-four hours later all these flies had succumbed but 5. These 5, together with 5 dead ones, were chosen and their intestinal contents examined, and showed that 4 of these insects contained lepra bacilli; 6 insects showed no lepra bacilli in their intestinal tracts.

Experiment 3.—Placed 100 flies in a large jar, gave them undiluted scrapings of leprous ulcers, these scrapings being very rich in lepra bacilli. Hung 14 glass slides in the jar for the insects to roost upon.

Twenty-four hours later about one-half of the insects were dead, the slides were removed, and the numerous specks contained on them were examined in the usual manner. The results of the examination of these specks were as follows:

147 specks were examined.
106 specks showed no lepra bacilli.
41 specks showed lepra bacilli.

In these latter the number of bacilli was simply enormous, the lowest number being present in any one of the 41 specks was 6,300, the largest number 28,000, the average being 17,500 per speck.

Of the 147 specks thus deposited on the slides in the first twenty-four hours, 41 contained a total of 717,500 lepra bacilli. The specks deposited on these slides were but a small percentage of the total number deposited on the other parts of the cage.

The food containing lepra bacilli was now removed and bouillon substituted.

After twenty-four hours more—i. e., forty-eight hours from the time the leprous material was given the flies, and twenty-four hours from the time that it was taken out of the cage, nearly all the insects had died. Four or five remained alive, but rested upon the bottom of the cage and were entirely inactive.

The slides which had hung in the cage from the time the leprous material was removed up to the time the flies had died were withdrawn, but showed only 16 well-defined specks. These were stained in the usual manner and examined:

16 specks were examined.
13 specks showed lepra bacilli.
3 specks showed no lepra bacilli.
Of the 13 specks, the smallest number of lepra bacilli in 1 speck was 250; the largest number, 36,000; and the average number, 12,950.

The experiment was closed here on account of the death of the insects.

Experiment 4.—Placed 100 flies in four cages—i. e., 25 insects to each cage, and fed them fresh, undiluted scrapings from leprous ulcers.

On the following day, of the 100 flies only 12 remained alive (the cause of death unknown). Removed the slides and examined them with the following results:

47 well-defined specks were deposited on the slides during the first twenty-four hours of the experiment.
27 specks showed no lepra bacilli.
20 specks showed lepra bacilli (the average number of bacilli of the 20 specks was approximately 2,200 bacilli per speck).

The leprous material was now removed and the 12 surviving flies placed in one cage and given sterile bouillon as food.

Twenty-four hours later only 6 of these insects were alive. By chance no feces had been deposited on the glass slides, so no examination of the feces was made. The 6 dead flies were smeared and examined. The intestinal contents in each fly showed a moderate number of lepra bacilli; no count of the number of bacilli per smear was made.

Twenty-four hours later—i. e., three days from the beginning of the experiment, only 2 flies remained alive, no specks being deposited upon the glass slides. These two insects were killed with chloroform and examined, but no lepra bacilli were found in their intestinal contents.

Experiment 5.—Placed 100 flies in a cage; gave them undiluted scrapings of leprous ulcers; also gave them broth containing sugar, in hopes of prolonging their lives, in order to ascertain more definitely than the previous experiments have shown how long the lepra bacilli are present in the intestines.

Twenty-four hours later found most of the insects alive. These were removed to another cage; the specks on the slides, which latter had been hanging in the former cage for the first twenty-four hours of the experiment, were stained in the usual manner. They showed 34 well-marked specks.

34 specks were examined.
11 specks showed no lepra bacilli.
23 specks showed lepra bacilli (the number varying from 20 bacilli to 30,000 bacilli per speck, the average number per speck being 2,160 bacilli).

Inasmuch as it was believed that the manipulation necessary for the transfer of these insects might be responsible for the mortality they were allowed to remain three days after the above transfer without being disturbed—i. e., four days from the beginning of the experiment. They were given fresh food and slides.

Twenty-four hours after these latter slides were placed in the cage—i. e., five days from the beginning of the experiment, and four days from the removal of the leprous material, 17 flies still survived, and 21 specks had been deposited upon the slides hung in the jar.

21 specks were examined.
19 specks showed no lepra bacilli.
2 specks showed lepra bacilli (1 of these specks contained 14 lepra bacilli, and the other speck contained 175 lepra bacilli).

On the afternoon of the same day the 17 flies remaining alive were killed with chloroform and examined. Their intestinal contents showed no lepra bacilli, they having freed themselves of them in four days and a few hours from the time they had had the last opportunity to feed upon the bacilli, and five days and a few hours from the time they had the first opportunity to feed on the bacilli.

Experiment 6.—Placed 100 house flies (*Musca domestica*) in a jar, gave them the undiluted scrapings of a leprous ulcer, also (separately) sugar broth. The flies at first lit upon the leprous scrapings and fed from them freely, for the time being neglecting the broth. They were furnished clean slides, as in the previous experiments.

Twenty-four hours later the leprous material was taken away from them and more sterile sugar broth placed in a clean cage, into which the insects were transferred. The slides, that had hung in the cage from the time that the leprous material was fed up to the time the same material was withdrawn—i. e., twenty-four hours during the first experiment, were removed; the specks contained on these slides were stained and examined with the following results:

61 specks were examined.
49 specks showed no lepra bacilli.
12 specks contained lepra bacilli.

These 12 specks containing lepra bacilli showed these organisms to be present in immense numbers, the average number of lepra bacilli per speck being 18,000; 1 speck showed over 32,000 lepra bacilli.

At the end of another twenty-four hours the insects were again removed to a clean cage, given fresh, sterile food and clean slides. The old slides, which had hung in the jar from the time that the leprous material was taken from the flies up to twenty-four hours following this event, were removed, and the specks stained and examined with the following results:

78 specks were examined.
75 specks showed the presence of lepra bacilli.
3 specks showed no lepra bacilli.
The average number of lepra bacilli per speck was 13,500.

Twenty-four hours later the flies were again transferred to a cage, supplied with fresh, sterile food and clean slides. The old slides were removed and their specks stained and examined with the following results:

86 specks were examined.
54 specks showed lepra bacilli.
32 specks showed no lepra bacilli.
The average number of lepra bacilli per speck was 887.

Twenty-four hours later the insects were again transferred to a clean cage and furnished with sterile sugar broth and fresh slides. The old slides were removed and the specks contained on same stained and examined with the following results:

47 specks were examined.
17 specks showed lepra bacilli.
30 specks showed no lepra bacilli.
The average number of lepra bacilli per speck (considering the 17 specks only) was 32.

Twenty-four hours later the insects were transferred to another cage and furnished with sterile food and clean slides. The old slides

were removed and the specks contained on same stained and examined with the following results:

34 specks were examined.
No lepra bacilli were found in any of the specks.

Twenty-four hours later about 50 of the original 100 flies were still alive. These were killed with chloroform; 39 of these insects were chosen, their intestinal contents smeared on glass slides, stained, and examined; no acid-fast bacilli were found in their intestinal tracts.

Experiment 7.—Placed 100 house flies (*Musca domestica*) in a clean jar and gave them glass slides to roost upon and sterile sugar bouillion for food. Into this jar we introduced scrapings of a leprous ulcer, rich in lepra bacilli.

On the following day, i. e., twenty-four hours from the beginning of the experiment, the leprous material was withdrawn, the insects were transferred to a clean cage, and furnished sterile sugar broth for food. The old slides were taken out of the former cage and clean slides hung in the new cage. The specks contained on the old slides were stained and examined with the following results:

185 specks were examined.
116 specks showed lepra bacilli.
69 specks showed no lepra bacilli.

No count of the number of lepra bacilli per speck was made, but the average ran high into the thousands.

Twenty-four hours later, i. e., twenty-four hours from the time the leprous material had been withdrawn from the flies, the insects were changed to another clean cage and given fresh food and clean slides. The old slides were removed, but not examined on account of the pressure of other work.

Twenty-four hours later the insects were changed to another clean cage and given clean slides and fresh sterile food. The old slides that had hung in the old cage for the last twenty-four hours were removed, but for the reason stated in the last experiment were not examined.

Twenty-four hours later, i. e., seventy-two hours from the time the leprous material was taken away from the flies, the insects were changed to another clean cage, and the slides that had hung in the cage from the forty-eighth to the seventy-second hour from the time that the leprous material had been withdrawn were stained and examined with the following results:

81 specks were examined.
34 specks showed lepra bacilli.
47 specks showed no lepra bacilli.
Considering the 34 specks alone, the average number of lepra bacilli per speck was 673.

Twenty-four hours later, i. e., ninety-six hours from the time that the leprous material was taken away from the flies, the insects were transferred to another clean cage and furnished with fresh slides and

sterile food. The old slides which had hung in the cage from the seventy-second hour to the ninety-sixth hour from the last opportunity the insects had had for feeding on the leprous material were removed, stained, and examined, with the following results:

32 specks were examined.
11 specks showed lepra bacilli.
21 specks showed no lepra bacilli.
The average number of lepra bacilli per speck (the 11 specks alone considered) was 93.

Twenty-four hours later we removed the flies to another clean cage, supplied them with fresh food and slides, removed the slides which had hung in the cage for the previous twenty-four hours, and stained and examined them with the following results:

27 specks were examined.
No lepra bacilli were found in any of the specks.

The insects were on the same day killed by means of chloroform, 39 having still survived out of the original 100. The bodies of 17 of these were chosen, their intestinal contents smeared on glass slides, stained, and examined. No lepra bacilli were found in any of the insects.

Lepra Bacilli and *Sarcophaga barbata*.

Captured 5 specimens of *Sarcophaga barbata* and placed each in a bottle; made an artificial ulcer, in a manner previously described, on the abdomen of a rabbit; made a suspension of lepra bacilli (but from the material at hand the suspension was poor in these organisms) and filled the ulcer with it.

Experiment 1.—The first insect was placed over the ulcer. It lit near its border and appeared to feed, but of this we could not be certain, as it was on the ulcer but an instant. Fifteen minutes after it had lit on the ulcer it was killed with chloroform and examined, but no lepra bacilli were found. The insect did not deposit larvæ.

Experiment 2.—Four insects were placed separately, one after the other, over the same ulcer; all lit near the ulcer, but remained there only for an instant. The insects apparently fed a little, but of this we could not be certain.

The hesitation of these insects to partake freely of the food offered to them may have been due to the employment of a hair-removing preparation instead of a razor on the abdomen of the rabbit previous to the experiment. None of these insects deposited any larvæ on the ulcer's edge, but 3 of them deposited larvæ freely after being placed in their cages. Fifteen minutes after these insects had apparently fed they were destroyed with chloroform; 2 of them showed no lepra bacilli in their intestinal contents, while 2 of them showed a large number.

Experiment 3.—Took 1 specimen of *Sarcophaga barbata* and placed it over an artificial ulcer made in the skin of the abdomen of a guinea pig and infected with the scrapings of a human leprous ulcer. The insect fed, but did not deposit larvæ.

The following morning the fly was still alive and was killed with chloroform. A smear of its intestinal contents was made, stained, and examined. It showed a number of lepra bacilli, on an average 30 to an oil-immersion field.

During the night following the feeding this insect had deposited 6 specks. These 6 specks were stained and examined and all found to contain lepra bacilli, the average being something over 1,100 lepra bacilli per speck.

Experiment 4.—Placed 12 specimens of *Sarcophaga barbata* over an artificial ulcer made in the skin covering the abdomen of a guinea pig, and which had been infected with human lepra bacilli obtained from the scrapings of an ulcer of a case of human leprosy. Seven of these insects were seen to light on the ulcer and appeared to feed; 5 of them would not feed. These insects were killed with chloroform at the end of eighteen hours and their intestinal contents smeared; 5 of them showed large numbers of lepra bacilli in their intestinal contents, while the others showed none. During the eighteen hours mentioned, preceding the death of the insects, they had deposited a number of specks. Twelve of these specks were chosen and examined with the following results:

12 specks were examined.
9 specks showed lepra bacilli.
3 specks showed no lepra bacilli.

Experiments with the Undetermined species of *Lucilia*.

Experiment 1.—In the manner previously described we made an artificial ulcer and infected it with the scrapings of a leprous ulcer. Placed 8 specimens of *Lucilia* over this ulcer; 3 apparently fed on this ulcer, and 5 of them did not feed.

On the following day the flies were killed and examined. Only 1 of these insects showed lepra bacilli in its intestinal contents, and this one contained exactly 98 in its whole intestinal tract.

Two specks were taken out of the cage (most of them were inaccessible, having been deposited on the coverings of the cage) and examined with the following results:

2 specks were examined.
1 speck contained 168 lepra bacilli.
1 speck contained over 1,800 lepra bacilli.

Comment: It would appear, from this experiment, that this *Lucilia* frees itself of its intestinal contents more rapidly than do the other insects. This would account for the peculiar result just noted.

Sarcophaga pallinervis.

No experiments were attempted with *Sarcophaga pallinervis* for two reasons—one, that it seemed it would have been an unnecessary repetition of the *Sarcophaga barbata's* experiments, these insects being closely allied; the other reason being that the sanitary regulations of the station have been so strictly enforced that all varieties of flies have become very scarce, and the *Sarcophaga pallinervis* has practically disappeared.

DISCUSSION.

The above data, taken together with the well-known habits of certain of these flies, establishes the truth of the following statements:

First. That given a bacilli-discharging leprous ulcer (and practically all leprous ulcers due to the breaking down of a leprous nodule do discharge bacilli), unprotected from the attacks of flies, these insects will convey the bacillus of leprosy to the skin of near-by healthy persons.

Second. That such insects will contaminate the foodstuffs of such persons with these organisms.

Third. That these insects deposit their feces on every conceivable surface, and such feces, becoming dry and pulverized, will in the form of "dust" convey the bacilli to the nasal mucosa of near-by persons.

That given such an unprotected ulcer, and the usual number of flies, this contamination of the skin and mucosa of near-by healthy persons will not be an unusual event, but will occur again and again, through an indefinite length of time, and the number of bacilli thus conveyed to healthy persons will be enormous.

This much the experiments show; but the below-mentioned points at once present themselves, and can not in our present state of knowledge be answered by laboratory data:

First. Is the skin (or abrasion of it), the mucosa of the digestive tract, or the nasal mucosa capable of being infected with leprosy?

Second. Are the bacilli that have been discharged from an ulcer and afterwards passed through a fly's digestive tract alive and capable of infecting man?

Third. Do epidemiological and clinical observations bear out the supposition that flies help to spread leprosy?

As to the first of these, we know that by some means lepra bacilli *do* gain entrance to the tissues of man. It is difficult to conceive how this is brought about, except that the bacilli penetrates one or more of the surfaces mentioned as being frequently contaminated, directly or indirectly, by the fecal contents of flies.

As to the second, on this we have very little data. In the well-known case of Arning [a] the prisoner Keanu was inoculated with a leprous nodule that had not broken down into an ulcer. The patient developed leprosy, but he had been in contact with lepers in his own family and in prison (Swift). Furthermore, he was a Hawaiian. The mathematical probabilities of one of these people developing leprosy under ordinary conditions is (and was at the time of the experiment) high.

Bearing on this we also have the case of Coffin,[b] in which a prisoner purposely inflicted a wound of the skin and inoculated himself with leprosy, employing in this case as material the pus of a leprous ulcer. The man developed leprosy, but he had, before inoculating himself, been exposed to lepers.

On the other hand, many alleged and authentic cases of human inoculation, performed usually by means of a wound of the skin, have failed to reproduce leprosy. In weighing this evidence, however, it must be remembered that much negative evidence is required to outweigh a very few positive results in a matter of this kind.

Bearing indirectly on this question, we know that in rat leprosy, a disease closely resembling human leprosy, the inoculation of an abrasion of the skin of a healthy rat with the bacilli contained in an ulcer of a leprous rat is usually followed by infection.

As to the third of these questions, Do epidemiological and clinical data bear out the supposition that flies help to spread leprosy? The writer, in connection with another work, has had occasion to review recently a large mass of data and opinions contained in the literature bearing on the general subject of transmission of leprosy. The most striking point that appears in much of the literature is the large number of lepers that give a history of personal contact of the most intimate character with a leper (for a long or short period) previous to developing the first symptoms of the disease. Examples could be cited that would seem to show that those persons who reside in the same house with a leper, but do not eat or sleep with or administer to the patient, are much less often attacked than persons who, in addition to residing with the afflicted person, also come in very intimate contact with him.

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[a] For details of this case, see The case of inoculated leprosy, by Arning, Dermat. Congress, Prague, Wiener med. Wochenschrift, No. 29; Editorial Lancet, July 27, 1889, p. 184; Scheube: Diseases of Warm Countries; also report of Emerson and Kimball in Tebb's The Recrudescence of Leprosy, p. 123; also Swift and another article by Swift and Montgomery, both reviewed by Baumgarten, vol. 6.

[b] Etude de la lèpre aux îles de Maurice et de la Réunion. Scheube: Diseases of Warm Countries.

This, of course, is against transmission by an insect having a considerable excursion of flight, like the fly. This observation is not strongly against household infection, for the probabilities of the fly carrying the infection to some one within the household are far greater than those of the insect carrying the infection to a near-by dwelling; but it is distinctly against fly-borne infection that a person sleeping in the next room should be quite exempt, while the person sleeping in the same room is apt to be infected. We do not admit such is the case, however, although the experience of many would appear to indicate this.

In considering the matter, it should be remembered that it is improbable than any *one* insect, mechanism, or means is alone responsible for the spread of leprosy; furthermore, that while observations of a clinical and epidemiological character should be given due weight, it must be remembered that data of that kind has often led to errors.

CONCLUSIONS.

First. That the above-named flies, when given an opportunity to feed upon leprous fluids, will contain the bacilli in their intestinal tracts and feces for several days after such feeding.

Second. That the above fact, together with the well-known habits of these flies, make it certain that, given an exposed leprous ulcer, these insects will frequently convey immense numbers of lepra bacilli, directly or indirectly, to the skins, nasal mucosa, and digestive tracts of healthy persons.

Third. That our present state of knowledge does not permit us to determine whether such insect-borne bacilli are or are not capable of infecting persons whose skin and mucosa are thus contaminated; but until we have more accurate knowledge on this point we are justified in regarding these insects with grave suspicion as being one of the means of disseminating leprous infection.

HEREDITY VERSUS ENVIRONMENT IN LEPROSY.

By Harry T. Hollman,
Acting Assistant Surgeon, Leprosy Investigation Station, Public Health and Marine-Hospital Service.

In 1885 the Board of Health of Hawaii established a home in Honolulu for nonleprous girls born of leprous parents. It was not until 1908, under Dr. L. E. Cofer, U. S. Public Health and Marine-Hospital Service, then acting president of the Board of Health of Hawaii, that a home for nonleprous boys born of leprous parents was established.

Therefore, prior to 1908 the boys born at the Leper Settlement on Molokai were exposed to the disease for a longer average period than were the girls born there.

Having a knowledge of these facts, studies were undertaken by me in order to ascertain the influence of heredity and environment in the causation of leprosy.

For a number of years it has been said that "a very small percentage of the number of children born of leprous parents in Hawaii developed leprosy if removed early from exposure."

Fitch (1) said: "In eighteen years only twenty-six children were born, and only two of these became lepers in Molokai."

James C. White (2) has also said: "But two children born in Molokai have contracted the disease."

These and many other assertions regarding the birth rate of children born of leprous parents and the subsequent development of leprosy among them are incorrect, as accurate data could not have been obtained. For example, in the biennial report of the president of the Board of Health of Hawaii, ending 1892, the superintendent of the Leper Settlement, in giving the number of children born to lepers, writes: "There is probably an error in this figure."

In studying the data collected the following points have been considered: First, whether or not the length of exposure was in direct ratio to the number of cases of leprosy developing in children born of leprous parents; second, if heredity per se is a factor in the causation of leprosy.

In order to obtain material for this study the following records were carefully searched: Records of births and deaths in the Leper Settlement since 1896, when registration was made compulsory; records of declared lepers; records of nonleprous boys' home; records

of nonleprous girls' home; records of the superintendent's office at the Leper Settlement since 1880.

The results are tabluated in three groups: Group I, male and female children born of leprous parents, whose life histories to July 31, 1909, are known, and who were under observation ten or more years; Group II, male children born of leprous parents, whose periods of exposure are known, and who were under observation at least seven years; Group III, female children born of leprous parents, whose periods of exposure are known, and who have been under observation at least seven years.

GROUP I.

From January 1, 1896, to July 31, 1909, 262 children were born of leprous parents, 128 being males and 134 females. Of the males, 51 died (nearly 40 per cent) under one year; of the females, 56 died under one year (41 per cent).

There were under observation for ten or more years, 22 males and 24 females. The length of exposure of the 22 males was ten or more years; the lengths of exposures of the 24 females were as follows:

One year or less	4	Six years	2
Two years	5	Seven years	4
Three years	2	Eight years	1
Four years	4	Twelve years	1
Five years	1		

The minimum time of exposure was eighteen days, the maximum time of exposure was twelve years, and the average time of exposure was four and seventeen twenty-fourths years.

Of the 22 males continuously exposed ten or more years, 7 contracted leprosy at the following ages: One at 4 years (father and mother advanced tubercular lepers), 3 at 6 years, 2 at 7 years, and 1 at 9 years. The average age at which leprosy was contracted was $6\frac{4}{7}$ years.

Of the 24 females whose average exposure was four and seventeen twenty-fourths years, 1 contracted leprosy. This case was removed from exposure at the age of 3 years.

GROUP II.

Thirty male children born of leprous parents, whose periods of exposure are known, and who were under observation ten or more years. They were exposed as follows:

Twenty-three years	1	Fourteen years	6
Twenty years	1	Eleven years	3
Nineteen years	2	Ten years	1
Eighteen years	1	Eight years	5
Seventeen years	3	Seven years	3
Fifteen years	4		

The maximum time of exposure was twenty-three years, the minimum time of exposure was seven years, and the average time of exposure was thirteen and twenty-six one-hundredths years. Of these 30 cases 3 (or 10 per cent) contracted leprosy, 2 at the age of 15 years and 1 at the age of 7 years.

GROUP III.

Seventy-eight female children born of leprous parents, whose lengths of exposure were known, and who were under observation seven or more years. Their exposures were as follows:

Seventeen years	1	Eight years	7
Sixteen years	1	Seven years	8
Fifteen years	2	Six years	2
Fourteen years	3	Five years	2
Thirteen years	5	Four years	5
Twelve years	5	Three years	7
Eleven years	2	Two years	7
Ten years	7	One year	8
Nine years	6		

The maximum time of exposure was seventeen years, the minimum time of exposure was one year, and the average time of exposure was seven and one-half years.

Of these 78 cases 12 contracted leprosy, after the following lengths of exposure:

After exposure of—	
Seventeen years	1
Thirteen years (developing disease in her fourteenth year)	1
Thirteen years	1
Twelve years	1
Nine years	1
Eight years	1
Seven years (contracted at 7 years)	3
Four years (developing disease at 11 years)	1
Two years (developing disease in her tenth year)	1
One year (developing disease in her seventh year)	1

The average time of exposure was eight and thirty-six one-hundredths years. In the 4 cases of which we have accurate data, the average time between cessation of exposure and detection as a leper was five and a half years.

SUMMARY.

I. It is shown that 40 per cent of the children born of parents one or both of whom were lepers died under one year.

II. Thirty-two per cent of the males who were exposed ten or more years developed leprosy.

III. Four per cent of the females whose average time of exposure was less than five years developed leprosy.

IV. Ten per cent of the males exposed for more than seven years developed the disease.

V. Thirteen per cent of the females exposed from one to seventeen years and under observation seven or more years became lepers.

VI. The average time of exposure of the cases which developed leprosy was five years.

DISCUSSION.

The high death rate among children born of leprous parents is what one would expect to find. The parents, being the battleground of a conflict between the lepra bacilli and their tissues, would not be expected to produce strong, healthy children.

A comparison of the number of male children who were exposed ten or more years and developed leprosy (32 per cent) with the number of female children who were exposed less than half as long and developed the disease (4 per cent) would tend to show that the danger of contracting leprosy for children born of leprous parents is in direct ratio to the length of the exposure.

The results presented under Group I, although based on a total of only 46 cases who survived the first year and became long exposures (males) and short exposures (females), are convincing, because the data are complete and further substantiated by the summaries presented in Groups II and III.

It is evident from the data contained in Groups II and III that a much higher percentage of the female children who were exposed for a long period of time to the disease became lepers than the males (13 to 10). According to Brinckerhoff (3), the ratio in Hawaii of the sexes of those who are declared lepers is 65½ per cent males to 34½ per cent females.

The difference in our group averages may be due to one or more causes.

The number of females (78) in Group III may be too large to compare accurately with the males (30) in Group II, or, as seems far more plausible, female children, born of leprous parents when under long exposure to the disease, are from their sex more in direct contact with leprous contagion, i. e., household duties, washing clothes, etc., while boys are, as any other boys, more out of the house than in it, hence in much less direct contact with the contagion.

Notwithstanding this difference, Groups II and III give emphasis to the fact that the longer the exposure the more cases of leprosy develop in the children.

In the opinion of many authorities leprosy is contracted by contagion only. Impey (4) says, "Leprosy is spread by contagion only." Thompson (5) has written, "Infection is received by man from his environment rather than from the sick" (house infection). Pernet (6), in speaking of the Purulia conference, says, "The delegates arrived at an unanimous opinion that leprosy is contagious," while Donovan (8) quotes Kaposi as follows: "Lepra has never been

observed in the children of leprous parents immediately or within a short period after birth." Espinet (13) wrote that he had never seen it in children under 3 or 4 years of age. Castor (12), according to Thin, had seen no case of congenital leprosy. Sanddreczki (14), in A Study of Leprosy, said he had never observed it in the newly born. The leprosy commission in India (11), in their report, said, "No case of congenital leprosy was seen." To quote from a lay authority on lepers, Mr. Jackson (15) of the mission to lepers in India and the East, in his book In Leper Land, says: "At one of the Indian missions, previous to the establishment of a home for the children of lepers, the former lived with their parents continuously, and as a result most of them developed leprosy; in fact, Reverend Guilford states of these children (before the establishment of a separate home): 'Of all those born there during the last thirty years I know of only two men who have not become confirmed lepers, and even these, when I last saw them, began to show signs of the disease. * * * while during the same period (thirty years) at another asylum near by means of separating the children have existed and among these only 1 case of leprosy has developed.' "

The leprosy commission in India in 1890 found that "of children born of leprous parents only a very small number became leprous; thus 98 leprous couples had 65 children, and of these 3 became lepers. Among 500 children born of two leprous parents, or from one leprous parent and one healthy parent, 21, or 4.2 per cent, became lepers." They also state, "Leprosy is certainly not found as often as in 1 out of 100,000 cases at an infantile period."

This is, in fact, an argument for the transmission of the disease by contact, as our observations and those of others show that a certain percentage of children, when exposed, will contract the disease.

Therefore the sooner after birth a child born of leprous parents is removed from exposure the less likelihood is there of its subsequently developing leprosy.

From a study of those of our cases who developed leprosy, and of whom there are accurate data, it is learned that the average time of exposure was five years, and that the disease was on an average five years in developing after the cessation of exposure.[a]

Although many authorities cite cases born with recognizable lesions, in our studies of the 262 cases we found no record of any child having recognizable lesions of leprosy at birth. Reschetillo (7) mentions 28 children born of leprous parents, 3 of whom had recognizable lesions. Navarro (16) has reported 2 cases of congenital leprosy. Hansen (9) has reported having found lepra bacilli in the

[a] There may be an unavoidable error here, as the disease may have been far advanced when they were pronounced lepers. Our data simply state the time they were officially declared lepers.

seminiferous tubules of the testicle, and Babes, according to Babs (10), has found lepra bacilli in semen with living spermatozoa and in the egg sack of the ovary, while Arning (10), according to the same author, has found lepra bacilla in the ovary. Nevertheless, heredity apparently played no part in the causation of our cases.

CONCLUSIONS.

First. The danger of contracting leprosy for children born of leprous parents increases with the length of exposure.

Second. Heredity is not an important factor in the causation of leprosy.

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TREASURY DEPARTMENT

Public Health and Marine-Hospital Service of the United States

PUBLIC HEALTH BULLETIN No. 40

TRANSACTIONS OF THE

Eighth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service

WASHINGTON, D. C.

APRIL 30, 1910

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1910

CONTENTS.

APPENDIX.

LETTER CALLING EIGHTH ANNUAL CONFERENCE.

The following letter was addressed to the health authorities of each State, Territory, and the District of Columbia:

TREASURY DEPARTMENT,
PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
Washington, February 5, 1910.

DEAR DOCTOR: I have the honor to inform you that the Eighth Annual Conference of State and Territorial Health Authorities with the Public Health and Marine-Hospital Service will be held at the bureau, 3 B street SE., Washington, D. C., April 30, 1910, at 10.30 a. m. In accordance with the act approved July 1, 1902, each state board of health will be entitled to one representative.

It is respectfully urged that every State and Territory be represented, as important matters in relation to morbidity returns, transportation of the dead, prevention of typhoid fever, and other subjects will be brought before the conference.

I have to request that I be informed in advance of the name of the delegate who will represent your health organization.

Respectfully,

WALTER WYMAN, *Surgeon-General.*

Eighth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service.

TRANSACTIONS.

MORNING SESSION.

April 30, 1910.

The Eighth Annual Conference of State and Territorial Health Officers with the Public Health and Marine-Hospital Service was called to order at the Bureau of Public Health and Marine-Hospital Service by Surg. Gen. Walter Wyman at 10.45 a. m., the following being present:

United States Public Health and Marine-Hospital Service: Surg. Gen. Walter Wyman, Asst. Surg. Gen. L. E. Cofer, Asst. Surg. Gen. J. W. Kerr, Asst. Surg. Gen. J. W. Trask, and Passed Asst. Surg. J. F. Anderson.

Arizona: Dr. E. S. Godfrey.

California: Dr. W. F. Snow and Dr. Charles C. Browning.

Connecticut: Dr. J. H. Townsend.

Delaware: Dr. A. E. Frantz and Dr. J. W. De Witt.

District of Columbia: Dr. W. C. Woodward.

Florida: Dr. J. Y. Porter and Dr. Hiram Byrd.

Georgia: Dr. H. F. Harris.

Iowa: Dr. G. H. Sumner.

Kansas: Dr. S. J. Crumbine.

Kentucky: Dr. J. N. McCormack.

Louisiana: Dr. Thomas A. Roy.

Maryland: Dr. M. L. Price.

Massachusetts: Dr. M. W. Richardson.

Michigan: Dr. F. W. Shumway.

Minnesota: Dr. H. M. Bracken and Dr. H. W. Hill.

New Mexico: Mr. Edward C. Wade, jr.

North Dakota: Dr. J. Grassick.

Ohio: Dr. C. O. Probst.

Pennsylvania: Dr. W. R. Batt.

Rhode Island: Dr. Gardner T. Swarts.

South Carolina: Dr. C. F. Williams.

Tennessee: Dr. J. A. Albright.

Vermont: Dr. H. D. Holton.

Virginia: Dr. E. G. Williams and Dr. A. W. Freeman.

Washington: Dr. Elmer E. Heg.

Wisconsin: Dr. C. A. Harper.

The SURGEON-GENERAL. Gentlemen, it gives me pleasure to greet you in this the eighth annual conference of the state boards of health with the service. I know that you have had a very busy time during the last three or four days, and we shall endeavor to make this meeting not too long. We have prepared a programme which I think is interesting, and I believe the discussions connected with it will be very helpful to us all.

I have nothing very special to communicate to you with regard to matters since our last meeting. It may not be out of place, however, to tell you of a sanitary convention in which you must all feel some interest—the Fourth International Sanitary Convention of the American Republics. I believe these conventions have never been mentioned before at any of these conferences, and what makes it pertinent to mention them now is that one was recently held in Costa Rica. These international sanitary conventions of the American Republics are held once every two years. The first one was held in Washington in 1902; the second one was to have been held in Chile in 1904, but circumstances prevented its being held there and it was held in Washington instead in 1905; the third was held in 1907 in the City of Mexico; and the fourth was held December, 25, 1909, to January 2, 1910, in the city of San Jose, Costa Rica. They are strictly official conventions, being the outgrowth of the International Conference of American States. The international conference that provided for these international sanitary conventions was held in the City of Mexico in 1900–1901, and was a conference of all the American States on everything pertaining to the welfare of the different American Republics. I have always seen to it that some representation in the delegation should be had from state and municipal health authorities, and at this last convention in Costa Rica it was so provided. There were three delegates, one gentleman connected with this conference and two others, but unfortunately none of them were able to go. It is a long trip, taking a week to get there by steamer, and one after the other the delegates referred to found it was impossible for them to go. There were three other delegates who went; two officers of our service, who had had special previous experience with these conventions and spoke Spanish. I am not going to dwell long on that convention, except to say that it was very successful and I believe did a great deal of good. There were twelve republics represented and the delegates were entertained by the Government of Costa Rica. The resolutions passed are all decidedly valuable and will be of practical benefit and direct application. They are simply resolutions expressing the opinions of official delegates from the respective republics, but if quarantine regulations or other regulations in conformity with these

resolutions are attempted to be established by the local or the national governments they will have the sanction of the other republics as expressed in these resolutions. For instance, one resolution related to a systematic extermination of rats on vessels. I have had in mind for a long while some such measure to prevent the spread of bubonic plague from country to country. While it is impossible to destroy rats completely in a city they can be destroyed completely on vessels; and the resolution in question was adopted calling upon masters and owners of vessels to see that at periodical intervals, say three times a year or intervals of less than six months, their vessels were fumigated at a time when it could be done properly, say when they were laid up, and thus destroy the rats. The idea is to destroy the rat population of commerce and in that way—there is no surer way of preventing the spread of bubonic plague throughout the world. While the opinion of the convention was expressed as a resolution, it has been embodied in the revised United States Quarantine Regulations in the form of a regulation which will be enforced, and owners whose vessels traffic between ports that have bubonic plague, or any suspicion of having had bubonic plague, will be compelled to direct that those vessels shall be fumigated at least once every six months to destroy the rats.

I shall not attempt to read all the resolutions that were passed, but there is one set of resolutions, five in number, that I think I had better explain to you. At the International Conference of American States held in Rio Janeiro in 1906, the one where you all remember Secretary Root was so cordially received and did so much toward bringing about amity among the American Republics—at this conference, which was not a medical or scientific conference, but a conference of diplomats and representative gentlemen, a resolution was adopted requiring the international sanitary convention to bring in a report as to practical methods of bringing about sanitation of the different ports. At the conference at San Jose, therefore, the resolutions were prepared and adopted and will be sent to this next meeting of the American States which is to be held in Buenos Aires in July, 1910. Now, these resolutions are all interesting to this conference because they express certain principles, and one in particular, which I think will meet with the approval of you gentlemen. The resolutions are very simple, but it must be remembered that they are intended particularly for application in certain small republics in Cenral America and some of the large republics of South America, where the conditions are entirely different from what they are here and where the amount of sanitary knowledge is less and sanitary ideals not so far advanced as they are here. The resolutions are not compulsory, but made as a report to the conference in Buenos Aires in July, and it is

thought that they will have a helpful effect in solving the problems to be considered there. The resolutions were as follows:

1. That careful statistics on population, morbidity, and mortality be kept at every port, such data to be compiled at regular intervals of not more than one month and also annually.

2. Every port should be provided with a proper system of sewerage, an adequate supply of pure water, and paved streets.

Of course with us the necessity of that measure would go without saying, but it does not go without saying in a good many small places in Central and South America.

3. That all habitations be constructed with a view to furnishing fresh air and sunlight sufficient to maintain the health and vigor of the inmates, and that the character of the construction shall conform to local conditions.

4. That in every port there shall be a sanitary authority clothed with ample power to vigorously enforce sanitary ordinances.

5. That it be made obligatory in schools to furnish instruction in the elementary principles of hygiene and sanitation. This instruction should be objective or by means of the publication of simple rules, or both.

I thought it would interest you gentlemen to know what is being done in our relations with our southern neighbors, Mexico and the Central and South American republics.

The bureau published recently a bulletin entitled "The rat and its relation to the public health," which most of you have seen, but it is possible that some of the delegates present have not received a copy, and I will have them passed around. We consider the bulletin a very valuable addition to the efforts to suppress particularly plague and to show the influence of rats on human diseases.

Now, with these few opening remarks I will just run over the proposed programme, which is subject to change. We propose to have a report of the committee on national care of lepers, of which Doctor Bracken is chairman; a report of the committee on the prevention of rabies, of which Doctor Anderson is chairman; report of the progress relative to the compilation of health laws, by Doctor Kerr; a discussion of the collection of morbidity statistics and compilation of morbidity statistics by the Federal Government, which will be of the greatest immediate use to state and territorial health authorities, by Doctor Williams, of Virginia; the best methods of securing reports of infectious diseases in a State, by Doctor Schumway, of Michigan; and an analysis of laws relating to the collection of morbidity statistics, by Doctor Trask, of our service. Then, another subject is the disposal and transportation of the dead in interstate traffic, regulations relative to the transportation of the dead, laws relating to the same, and what should constitute an approved disinfectant for embalming purposes. Doctor Cofer will discuss the transportation of the dead through quarantine stations from foreign ports and their delivery at destination. I know that you had a great deal of discussion on this subject

in your recent meeting, but there is one feature of it that interests us particularly, and that is the bringing home of bodies from foreign countries.

The first business is the report of the committee on national care of lepers, of which Doctor Bracken is chairman.

NATIONAL CARE OF LEPERS.

Doctor BRACKEN. Mr. Chairman and gentlemen, I am sorry to say that I have very little to report on this committee work. There has been no material change in the methods or in securing data as to how lepers should be taken care of. This question is constantly coming up and is going to annoy us in the future, but I do not know that we can do much. It seems as though we have got to depend largely on the Public Health and Marine-Hospital Service to push the matter, and if there can be an arrangement, as was originally intended, for a leprosarium in some one of the Territories or States it would be an excellent plan. I am sure that while the Federal Government can not compel lepers to go to a national institution, they could undoubtedly be sent by the States and municipalities to such an institution if it existed, and it certainly would be a haven for those unfortunates. I presume California and the Pacific coast are becoming somewhat annoyed on the leprosy question, because surely we are getting leprosy into this country from China, Japan, and possibly from the Philippines to some extent. I am sorry that I have not anything more to report for the committee.

The SURGEON-GENERAL. I believe this committee consists of Doctor Bracken, Doctor Porter, Doctor Hurty, and Doctor Bennett, and the idea was to have a resolution drawn up in regard to the subject. I would like to ask if this matter came up in your conference this year.

Doctor BRACKEN. There was a committee dealing with this question of which Doctor Woodward was chairman.

Doctor WOODWARD. We reiterated the resolutions adopted last year and suggested that if it was the desire of the conference that the matter be actively pushed—that is, this matter of establishing a national leprosarium—then the conference should appoint a committee to push it. I was not present when the resolutions came up and I do not know whether they appointed such a committee or not.

The SURGEON-GENERAL. Well, if you will send us a copy of those resolutions we will consider them as passed here. That was the understanding—that resolutions would be prepared by the committee or the conference.

Doctor SWARTS. That resolution is copied from the last transactions of the conference of state and provincial boards. They just copied

it as it was there, but with the proviso that if it should be approved the incoming president would appoint the committee.

The SURGEON-GENERAL. If there is no objection, then, that resolution will be considered as approved here. I might say with regard to the care of leprosy that a bill was introduced in 1905—a very carefully prepared bill—regarding which I had had the advice of a prominent member of the Interstate Commerce Commission at the time. The provisions of that bill were that there should be established a national leprosarium—and by the way we want to abandon that name, because that was what helped to kill the bill—a home for lepers would be better—and the surgeon in charge have the right to receive from any designated state health authority the person of a leper. The scheme also contemplated that there should be a corresponding legislative action on the part of the States, authorizing some person in the State to deliver to the national health authorities the body of a leper, and then that would give control of that leper to the national establishment, which would prevent his escape. At the same time the bill did not contemplate the forcible carrying of every leper to the leprosarium, but left it to the judgment of each state board of health as to whether a leper should be taken care of by the National Government or whether they would take care of him themselves. The idea was that there might be cases of leprosy which it would not be necessary to segregate at this national home if the state authorities were satisfied with their sanitary surroundings and enforced all sanitary regulations, but of course we know that there are a good many lepers that are paupers and can not be taken care of, and they are the class of patients that were really contemplated in the bill to be cared for. It was an excellent bill and passed the Senate, but was defeated on the floor of the House by the most amusing but alarming representations made by different Representatives.

Doctor SHUMWAY. Did that bill contain any provision for the care of the families of lepers?

The SURGEON-GENERAL. No; it was not mentioned in the bill, but I suppose that under its provisions only the lepers themselves could have been cared for. That is the important matter, you know. The plan was to take a government reservation, and the bill provided for $250,000 for the erection of necessary buildings. It was intended that they would have an attractive place where they would be glad to remain. It was a well-considered plan and it is unfortunate that the bill did not pass. John Sharp Williams, the minority leader in the House, opposed it on the ground of states' rights; but the great objection really came from a Delegate from a Territory, who thought we were going to place it in that Territory, and he made an appeal to his fellow-Congressmen, saying: "We have been for years trying to get statehood; no, you won't give us statehood, but you want to dump all

the lepers of the country on us." It may come up some time again, and it is a matter of judgment when to try to get it through.

Doctor Roy. Mr. Chairman, I would like to know how many of the States have lepers' homes?

The Surgeon-General. We have inquired into that. Your State has, as well as California and Massachusetts.

Doctor Roy. Yes; we have, and we have obtained the best kind of results there.

The Surgeon-General. You have the most notable leper home in the country.

Doctor Bracken. Do you take boarders? I believe Minnesota could send you one.

Doctor Roy. No; we are not looking for boarders; but our law is mandatory. We can arrest and compel every leper to go to the home. We do not take care of his family.

The Surgeon-General. Do you try to get every leper in?

Doctor Roy. Yes, sir; and as soon as we find his home we have him arrested, and if the diagnosis is confirmed we take him to the home.

The Surgeon-General. Without regard to whether or not he has good sanitary surroundings and conditions at his home?

Doctor Roy. Without regard to that.

Doctor Porter. It seems useless, Mr. Chairman, for the United States to be doing anything for this class of sufferers in view of the fact that the city of New York permits them to go at large. I have followed very closely the case of this unfortunate man Early, who was of so much trouble in this District, and I have had a letter from Doctor Darlington, commissioner of health of New York City, saying that he knew nothing about the man, that the health authorities of New York took no cognizance of lepers at all. Now, if they do that in a large metropolitan city like New York it certainly would cause us to hesitate and think over the question as to whether there is any existing necessity of segregating these unfortunates any more than segregating syphilitics in various stages of development.

Doctor Bracken. I do not think, Mr. President, that the States can follow New York City's example.

The Surgeon-General. I would remark that if we had the national leprosarium I think New York City would take a different attitude with regard to lepers.

Doctor Roy. The point I wanted to make was that our experience in Louisiana goes to show that with the present law operating there we can carry out a perfect system of protection of the masses of the people from the lepers, and I believe that if the different States—it may not be germane to the question at issue—but if the different States could adopt similar laws we could, as I said before, not only

free our people from the menace of leprosy, but isolate the lepers themselves under proper conditions.

Doctor HEG. I believe, Mr. Chairman, it has come to my knowledge in the last few months that your bureau has one leper at least in a marine hospital, and I wish to ask what provision your bureau has for taking care of lepers, if any, and what your probable policy is to be as to cases in your hospitals?

The SURGEON-GENERAL. If we have a leper in our own marine hospitals?

Doctor HEG. I know you picked up a sailor recently in Seattle who is a leper, and there was a suggestion made by your service officer, Doctor Glover, that the State take care of him. Now, as I had one leper and he had one leper I suggested that we shake dice. He was not authorized to do that and I wished to know what provision, if any, you had.

The SURGEON-GENERAL. Well, we have to take care of him if he is a sick sailor. We do not need any special authorization to segregate him. We could just put him in some separate building and take care of him. If he comes in quarantine, where we have every facility, we would have to take care of him. In a marine hospital we would also have to take care of him.

Doctor HEG. But have you means for segregating them at your marine hospitals?

The SURGEON-GENERAL. We have special contagious wards and plenty of room there to take care of sick sailors; but we can not take outsiders there, and that is the object of this bill—to give us a place for them.

Doctor HEG. I have but one leper, and he is not a citizen of the State or of the United States. He had been in this country, when we discovered he was a leper, just long enough to prevent the immigration authorities from deporting him. He wants to go home, and is trying to escape, and I believe he will. [Laughter.]

Doctor WOODWARD. It seems to me that Doctor Heg could ship his leper as an able seaman before the mast, and then maybe the Public Health and Marine-Hospital Service would be able to care for him.

Doctor SWARTS. Mr. President, I think the leprosarium, as carried on in Louisiana, is illustrative of the need of a leprosarium for the United States. I visited there about two years ago, and I think they had about sixty-odd lepers there. It can be readily seen what an advantage it is to have them segregated in that way, all banded together, where they can sympathize with each other in exile, instead of being isolated by ones and twos in the different States, separated from everybody else and without any companionship or even church on Sunday. At such a place they would have the attention of

medical officers, whereby an opportunity would be offered to apply any new method of treatment which might come to the fore, which could not be done in the individual cases and from which they would receive direct benefit.

Doctor BRACKEN. I asked Doctor Roy if they were taking boarders. That was in the way of a joke. But it is really not a joke. We all recognize Louisiana's good work. The other States have only two or three at the most, and it is a difficult problem to know what to do with them. We take care of our lepers in Minnesota in a way. Leprosy is not spreading there; it is on the decrease. But we have lepers, and we would be glad to send them to a place where they would be taken care of, and I have no doubt we could get the money to pay for their care from the county or the State. It occurred to me that your department could possibly, through arrangements with Louisiana, make official provision for a home for lepers in Louisiana. Maybe Louisiana would be glad to cooperate with you. At any rate I shall be very glad, I am sure, to hear from Louisiana if they will take some Minnesota lepers to board. I think the lepers would be happier than they are now. We have two lepers isolated on Minnesota farms, absolutely alone, and one poor leper we had a year or so ago hung himself, and I think it was the best thing he could do under the circumstances.

Doctor WOODWARD. Mr. Chairman, I would like to say a word with respect to leprosy, based on experience. When you get hold of a leper in a community, it is advisable to look on the case as a possible court case, and not only make a thorough examination to satisfy yourself as to the diagnosis of it, but prepare a history, with notes and sections, and preserve them, so that in the event of court proceedings you will be able to prove your case.

Doctor ROY. If this conference will make application in the proper manner, I certainly shall be glad to take the matter up and submit it to the proper authorities in my State.

The SURGEON-GENERAL. Who are the proper authorities, Doctor? Is it not a state institution?

Doctor ROY. Yes; it is a state institution; the State has bought the home and owns it, appropriating annually $18,000. It is in charge of Dr. Ralph Hopkins, at a small salary, with Dr. Isadore Dyar as consultant, at no salary. The Sisters of Charity give their services gratis. It is wonderful how easy it is to operate the home, once you have it organized in the proper way, and I believe that the other States that have leper populations of 20 or 25 might do likewise. Our present population is 63, and the per capita cost is $536.92. We have a law that is mandatory in so far as being able to arrest and take to the home anyone who has leprosy, and public opinion back

of this law is so absolute, and it gives such general satisfaction, that even the afflicted are glad to stay at the home.

Relative to intermarriage, I will say that no leprous persons are permitted to marry, and the sexes in the home are separated.

The SURGEON-GENERAL. Doctor, is there any incorporated association interested in the home?

Doctor ROY. It is a state institution.

Doctor PRICE. Who has control of the institution? Is it under the state board of health or a board of trustees?

Doctor ROY. It is in the hands of the state board of control for the leper home. The state board of health is not concerned in the management of this board, except it be in a supervisory manner, which our board may apply over all public institutions.

The SURGEON-GENERAL. Gentlemen, I think we had better pass on to the next subject, unless some one has some special desire to speak further on this subject. The next subject is the report of the committee on rabies by the chairman, Doctor Anderson.

REPORT OF THE COMMITTEE ON RABIES.

Doctor ANDERSON. Mr Chairman, the committee is much indebted to Doctor Stimson, of the Hygienic Laboratory, who has charge of the preparation of antirabic virus, for valuable aid in the preparation of this report, and also to some members of the committee for important suggestions, especially Doctor Woodward.

REPORT OF THE COMMITTEE FOR THE PREVENTION AND ERADICATION OF RABIES.

Your committee, after carefully considering this subject, has the honor to submit the following recommendations. It has not seemed wise to us to formulate specific regulations, but it is thought best to leave that to the individual States and Territories.

Suppressive measures against rabies.—The suppression of rabies wherever it exists is worth undertaking seriously from the view point of the sanitarian, the dog owner, and those who own valuable stock. The annual toll of human death is not very great, but a single death from a terrible disease which is preventable is a reproach to the sanitary administration. The loss of time and money to those exposed persons who are obliged to take the Pasteur treatment, frequently through no fault or neglect of their own, is very considerable. Their mental suffering can not be expressed in dollars and cents. During 1908 at least two large hunt clubs were obliged to destroy their entire kennels because of infection with rabies, and many hundreds of valuable dogs were sacrificed for the same reason. The loss of stock—cattle, horses, sheep, and swine—from rabies mounts up to thousands of dollars annually in some areas of the United States.

The measures by which rabies can be exterminated, or at least reduced to a minimum, are well known. It is their application which causes the difficulty, and the crux of this difficulty is popular sentiment and popular apathy. The average citizen either does not believe in the existence of rabies or takes no active interest in the matter until a personal experience affects his pocketbook or his personal comfort, and then the active interest which he suddenly develops extends no further than his personal affairs. Measures to be effective must be state-wide in their application, and a uniformity of legislative and executive action in contiguous States is necessary if any lasting benefit is to be secured.

The history of the fight against rabies in certain sections of Europe is especially instructive in this connection. Great Britain, an island, had little difficulty in completely eradicating rabies where the suppressive measures were administered centrally by the board of agriculture and fisheries in 1897, and in preventing its introduction by adequate quarantine. The same result was obtained in the Scandinavian countries, which are peninsular and have little connection with the mainland. Holland, less isolated, has been less successful, and Belgium, with an extensive French boundary line, still less so. In France the popular opposition to measures against the liberty of dogs, and especially muzzling, has prevented any considerable reduction in the prevalence of rabies except in certain parts where these measures have been well carried out. Germany points with justifiable pride to the extermination of the disease in certain parts where it was formerly very prevalent, but it has been powerless to prevent its persistence and even increase in certain border states, notably Silesia, where infection is continually received from Austria and where the racial and philological differences in the inhabitants tend to impair the effectiveness of measures.

The States of the Union are for the most part not separated by natural barriers competent to prevent the spread of rabies from one to another. Consequently a uniformity of method must be adopted in order to combat the disease successfully. Antirabic regulations must have an areal distribution as wide as that of the disease, and must persist until, as in England, the disease is completely eradicated. Otherwise local and periodic outbreaks are bound to occur and a condition as bad or worse than the present one will ensue.

Without indicating an exact form of regulations for the prevention of the spread of rabies, it may be well to discuss the measures which have proven valuable, what their limitations and especial indications for their employment are. In introduction it may be stated that the domestic dog and his wild congenors are the principal disseminators of rabies, and it is to prevent the possibility of transmission by these animals that measures must be directed. The wild animals—wolf, coyote, and in certain sections the skunk—are now fast being reduced to negligible numbers in the United States, and consequently require only local measures, such as are maintained against any noxious wild beast, to prevent their being a danger to man. As has been previously pointed out, the idea entertained by Simon and others that an intermediate host, such as the wild rabbit, is required for the reenforcement of rabies virus is probably erroneous and at any rate without epidemiological significance.

1. *Destruction of ownerless dogs.*—This is perhaps the most effectual single measure against rabies. It should obtain at all times and in all places, irrespective of the prevalence of rabies. It implies the maintenance of an official dog-catching force and a pound equipped for the humane destruction and detention of dogs. The personnel of the dog-catching force should be carefully selected with regard to probity and good judgment, since these qualities are necessary in those who have an unpopular duty to perform, and the lack of them soon leads to antagonism and even abuse on the part of the public. The ownerless dog, for the purposes of sanitary law, should be defined as a dog unprovided with a collar and license tag of the current year. Impounded dogs may be kept for a few days to permit of their redemption upon the payment of tax and costs. The sale of impounded dogs is to be discountenanced.

2. *Dog tax.*—This is also a permanent measure. All owned dogs should be taxed yearly. Payment of tax secures a license for one year and a tag to be worn continuously attached to the dog's collar. This tag bears the license number corresponding to the entry on the official register, the number of the year during which it is good, and the name of the place in which the license is issued. Changing the form of the tag from year to year renders obsolete tags more readily detectable.

A shield on the collar, bearing the name and address of the owner, is a convenience, but not a necessity, since these data can be obtained from the register by referring to the license number.

It is suggested in towns of such size and concentration of population that in the opinion of the authorities it would be practicable to have the tag affixed by the licensing officer or his assistants, in order that it may be securely attached, that the identification of the dog may be made complete, that the condition of health of the animal may be observed, and its sex ascertained.

The dog tax operates in the control of rabies by (*a*) rendering ownerless dogs recognizable by the absence of the tag of the current year; (*b*) reducing the total number of dogs kept, and (*c*) restricting the ownership of dogs to those who have some sense of their value and will consequently take better care of them.

The tax should be sufficiently high to accomplish the last two ends. Dog-tax moneys should be expended in the administration of the dog laws, and not used for unrelated purposes. Unspayed female dogs should be taxed at a higher rate than spayed females or male dogs, with a view to limiting the natural increase of the dog population. Evasion of this provision by deception should be punishable by fine or forfeiture of the dog or the right to keep dogs. In case the licensing officer or his assistant personally affixes the tag, evasion of this taxation is precluded.

3. Dog owners should be made legally responsible for damage inflicted by their dogs. The absurd practice now obtaining in some places of the public assumption of such damages and their defrayal out of the dog-license funds by the community should be discontinued. Damage by ownerless dogs may, however, be compensated out of public funds.

4. The education of the dog-owning public in matters relating to the care of dogs as affecting the spread of communicable diseases. Since public sentiment is such an important factor in the control of rabies, it should be intelligently directed by the authorities charged with this duty through their periodical official publications and leaflets and cordial cooperation of the officials with the public directly.

5. *Muzzling.*—This measure should be in constant application wherever rabies exists. It should be abandoned only when the disease has been absent from a region a sufficiently long time to warrant a feeling of security that it has been eradicated and is not merely in abeyance. This time varies much in different regulations now in vogue, but the opinion of many competent observers is that it should not be less than six months. Even this period can not be regarded as absolutely safe, since incubation periods in excess of this time are known to have obtained. Muzzling ordinances for certain months or seasons of the year, when based on a supposed seasonal prevalence, are, in the face of facts, illogical. They should be issued and maintained pro re nata. These regulations should involve not only the immediate vicinity concerned, but a sufficient zone about it to insure safety. From the known tendency of mad dogs to wander far, this zone should be commensurately wide.

Muzzling ordinances should prescribe that muzzles be constructed of metal, should prevent biting, should be humane, and permit of the dog's opening his mouth, and should be fitted to the animal, being changed from time to time, if necessary, with the animal's growth.

Efficient muzzling stands second only to the destruction of ownerless dogs in efficiency in reducing the number of animals, and in extensive epizootics takes the first place. Unfortunately it is always opposed by a considerable portion of the population, and in many places is not rigidly enforced. Popular enlightenment only can improve this condition. The chief objection against muzzling comes from the dog lover, who claims that it is cruel. There is some justice in this, inasmuch as an ill-constructed or ill-fitting muzzle undoubtedly causes suffering to the animal. A well-made metal muzzle of the basket type, permitting the dog to open its mouth but not to bite, and fitted to its head, is at least as humane as the bit which these critics place in the horses' mouth. Dogs soon become accustomed to wearing them and soon show their appreciation when they are applied, since they know that it means an outing for them.

It has been suggested that licensing authorities prescribe the exact type of muzzle to be employed, or even supply the muzzles themselves to secure a suitable article.

Where muzzling is prescribed for the fiscal license year it is recommended that the license tag be firmly affixed to the muzzle itself, so that an unmuzzled dog would be amenable to the rules applying to unlicensed animals.

Muzzling is effective by preventing dogs possibly afflicted with rabies from transmitting the disease by bites, by necessitating the frequent observation of dogs at feeding times, etc., and by indicating an ownerless dog by its absence. When a muzzle is removed from a dog during the period of the ordinance the animal should be restrained by chaining up or by confinement in a suitable inclosure to prevent its running at large.

6. *Restraint of dogs.*—The compulsory confinement of dogs by their owners on their private premises is a temporary measure employed with success in heavily infected regions. Its duration should not be less than three months, and its efficacy increases with a longer period of enforcement. The area of the application should be the same as that in the case of muzzling, upon which measure it may be superimposed if considered necessary. To provide for the exercise necessary to dogs which are thus confined, it should be permitted that they may be led muzzled in leash at public places. In England special provisions against the night wandering of dogs were found useful.

Special provision at all times should be made against the running at large of owned female dogs while in heat. Owners of such dogs who allow them at large at such times, even though properly tagged and muzzled, should be made subject to penalty. Female dogs in heat when at large cause the congregation of many dogs together, fights arise among them, and an opportunity for the transmission of rabies occurs if the disease be present in any stage of infectiousness among them. The progeny of such dogs is usually of an undesirable mongrel kind, and if not destroyed is soon turned loose to swell the wandering dog population.

7. *Leading in leash.*—This measure is not advised except the dog at the same time be muzzled. Evasions are so readily and frequently effected that provisions must be made, so that if the animal is temporarily released by its owner it will be powerless to inflict bites.

8. Compulsory notification of the authorities by dog owners and veterinarians of cases of rabies or suspected rabies in dogs or other animals is a useful measure in the early discovery of foci of infection. It should be followed by immediate official veterinary investigation and the destruction of the animal if the diagnosis be confirmed. In case of doubt, especially where a person has been bitten by the animal, effective isolation and observation for at least ten days, if necessary, should be instituted, to allow time for the development of pronounced symptoms, and the confirmation or disproval of the suspicion. The heads of animals so destroyed should be sent for examination to a laboratory maintained by the authorities in charge of antirabic work. Disinfection under official supervision of kennels, stalls, etc., occupied by rabid animals is advisable.

Pending official investigation of suspected cases the animal should be safely confined, and curative measures should not be attempted on account of the danger of infection.

Bitten animals should also be reported, and in the case of dogs and cats it is wisest that they be destroyed. In the case of valuable stock it should be permitted that they be isolated or quarantined for at least six months from the time of the bite. It should be provided that if dogs, on account of their value, are ever permitted to be quarantined rather than immediately killed after being bitten by a rabid animal, this quarantine be carried out by the authorities or under their supervision, and that the expense be borne by the owner.

The commercial use of any part, including the hide, of an animal killed for rabies must be prohibited, unless such parts have previously been rendered innocuous to the satisfaction of the authorities. Proper disposal of carcasses must be enjoined.

Rabies or hydrophobia in man should be made "reportable" throughout the country.

9. *Quarantine.*—To prevent the introduction of rabies a quarantine of at least six months should be imposed upon imported dogs. One year would be a safer but scarcely more effectual period, since there are few enthusiasts who would submit to a six months' detention of their dogs or attempt to import them were this enforced. Quarantine has been effectual in preventing the introduction of rabies in Australia, where the long journey is a strong adjunct, and in England. In the latter country special provisions are made for performing dogs, which permit their introduction into the country under strict police supervision. In Germany dogs may not be moved from one section to another without a certificate from an official veterinarian and other provisions. The expense of quarantine must be borne by the owner.

10. Immunization of the lower animals has been suggested and even carried out to a slight extent. It is not applicable to dogs, since it is evident that no large proportion of a dog population can be reached by any such method. Valuable dogs should be so cared for that no danger of infection exists. In the event of such a dog being bitten protective inoculations may be given if commenced with little delay to save the life of the animal, but not as a general sanitary measure.

Herds of cattle have been successfully protected by inoculating them; but it is reported that in the method employed—intravenous injection—there was some loss from infection. In our opinion this method of preventing the spread of rabies in the lower animals is not worthy of serious consideration.

John F. Anderson, *Chairman.*
Gardner Swarts.
Wm. C. Woodward.
C. O. Probst.

The Surgeon-General. The report of the committee is now before the conference for discussion.

Doctor Frantz. Mr. Chairman, for the benefit of the rest of the States I would like to inform the conference that the state board of health of Delaware is now completing the giving of a course of treatment from the Hygienic Laboratory. I do not know whether the rest of the state boards are acquainted with the fact that treatments can be secured from this institution.

Doctor Snow. I would like to ask two or three questions in regard to this matter. This is the second time that rabies has appeared in southern California. There was one outbreak about eleven years ago, when we presumed it had been stamped out. But within the last two years there have been from time to time some cases appearing in animals, and we have had a great deal of difficulty in getting the people—certain classes of people—interested in prevention of the disease. Los Angeles had an ordinance passed at one time, but the Society for the Prevention of Cruelty to Animals came before the city trustees and caused the repeal of the act. It was not until after a death in a human that the disease attracted attention, and the ordinance was reenacted. I have taken occasion from time to time to recommend that people make application to this bureau for literature in regard to rabies. If the information comes from this bureau it carries with it the authority of the United States Government, and I would like to ask if the health authorities of a community should send in the names of a large number of

people whether you could send it to these individuals, or must they apply personally?

The SURGEON-GENERAL. They must apply to the state boards of health. We only send it to the state boards of health.

A MEMBER. He does not mean the virus.

The SURGEON-GENERAL. Oh, the literature?

Doctor SNOW. Yes, sir.

The SURGEON-GENERAL. We send it direct. Let them apply direct. We are pleased to send all we can to anybody.

Doctor SNOW. You would not be in a position, then, if we should send the names of fifty people—could you send it to these individuals?

The SURGEON-GENERAL. Yes; right to the individuals. They then make application through the state board of health and use the virus prepared here.

Doctor SNOW. Another question I would like to ask of Doctor Anderson is whether they have known of coyotes transmitting the disease to dogs. Where there has not been definite evidence of other infection, that is the presumable way that possibly it has reached our section.

Doctor BRACKEN. I was very much pleased with the report of the committee. But I noticed that Doctor Anderson used the term "tax." I think you used it quite generally, Doctor. Now, the word "tax" is rather unfortunate; the word "license" is better. We have a legislator who introduced a very good bill looking to the licensing of all dogs, but he used the term "dog tax," and at once there was an outcry that it was unconstitutional, etc.; that they all paid the dog taxes in paying their general taxes, and the bill was killed. The entire bill was good, because it provided for the ones who would do the killing; provided a compensation for the killing and also provided that the surplus after the compensation for killing had been paid should go into the educational fund, which was meant to create a sentiment in favor of it, and a small part—20 per cent, I believe—was to go to the state board of health to maintain a Pasteur institute. Now, I do not know that any State can enforce such a law if a sentiment against taxing dogs and dog licenses prevails in other States as it does in Minnesota. We tried to get the same legislator to introduce a bill the next year, but he said, "Oh, no; the sentiment against my introducing the former was so great that I came pretty near not getting back this year." So the only thing is, if the District of Columbia can introduce here an ideal system of dog licensing, maybe we can then get something in the States. It certainly is one of the important ways of controlling this disease if the people could be educated up to it. We ought to reach this through the loss of stock, because that affects the farmer more than the loss of a human being.

A MEMBER. Who would have collected that tax?

Doctor BRACKEN. I do not remember exactly. It was a dollar for male dogs and a dollar and fifty cents for females, in addition to the municipal and county taxes. We did not have opposition at first from the Humane Society of Minneapolis; in fact, it was taken up with them and the understanding was that they would destroy the dogs in a manner that they thought humane.

Doctor SUMNER. I have been very much interested in this discussion. It just occurs to me that our State passed a law by which all hunters are taxed and licensed, and at the present time our State has received $105,000, paid in by hunters. This is to be spent in the interest of the fish and game of our State. This idea of taxing dogs seems to me a good one along the same line—to get a fund to be devoted to bacteriological purposes or scientific purposes and for the prevention of rabies—and it looks to me to be very reasonable.

Our State is appropriating only $6,000 for the maintenance of our bacteriological department and our bacteriologist is continually telling me that he is handicapped in consequence. He is doing some very excellent work with rabies, however, and a number of cases in our State have been treated successfully, and I trust Doctor Albert has reported the results of his clinical experiences to your laboratories. I believe, as Doctor Bracken has stated, that a proper start in the District of Columbia and a recommendation from this department would help materially and, as he stated, I would avoid the word "tax." I believe that we should adopt some measure whereby all dogs would be licensed and tagged in a proper way, and we should know that they are properly restrained. On the night of the 19th of this month, when returning from the State University at Iowa City, I arrived in Des Moines. A large dog came and jumped up at me. He was overly friendly and the first thing I tried to discover was whether he had a collar on whereby his owner might be known, but he bore no evidence of ownership whatever. I went on a little farther and saw other dogs not tagged.

If a man thinks enough of his dog to register him he will think enough of him to restrain him. I think with Doctor Bracken, of Minnesota—and I shall profit by his experience—that these animals should be registered and licensed and the money devoted to scientific purposes. If our State can get $105,000 from hunters, I do not see why we can not get $100,000 from dog owners.

Doctor SNOW. I would like to ask Doctor Anderson to express his opinion as to the probable way in which California has become infected. That is an important problem, and in California that is a question that is constantly asked of us, and people want some definite statement. Our state veterinarian has been quoted by the newspapers—of course, he has only given this as a theory—but it has

been quoted as a matter of fact in the newspapers, saying our infection first came into Stockton, in the northern part of the State, through the Ringling Brothers circus, and he holds that opinion because of the bacteriological evidence and chronological evidence in connection with the infection there entirely independent of the infection in Los Angeles. Doctor Browning mentions the fact that a good many people who come to Los Angeles from the East are accompanied by dogs and these dogs may have brought the infection.

Doctor Bracken. Last year it came out that a good many of the skunks in Texas were infected.

Doctor Woodward. I believe we should emphasize the importance of regulating the running at large of dogs at night. I have had some experience in enforcing muzzling ordinances which leads me to believe that some people who are law-abiding and conscientious in the daytime are not so at night. Dogs are turned at large at night to get their exercise, and it is practically impossible for the dog catchers to operate at night, if they are to base their operations on tagging and muzzling. They must act quickly and they can not see after dark, or even in the twilight, whether a dog is or is not tagged and muzzled. If, on the other hand, we could have a law authorizing us to impound, regardless of tag or muzzle, any dog running at large after dusk, we could suppress dogs running at large at night. As a matter of fact, no dog has any proper place at night off the premises of his owner.

Doctor Townsend. In Connecticut for the past two years we have had a number of dog's heads sent to our laboratory, but all examinations were negative. We have a system of licensing and tagging dogs similar to that described by Doctor Anderson and all cases of rabies are at once reported to the commissioner on domestic animals by the health officer of the town where the case occurs. The commissioner must make immediate investigation and make such rules for the adequate confinement, control, or destruction of dogs as he may deem necessary to prevent the spread of the disease. Under another provision of the law any person upon being bitten by a dog supposed to be mad may, on the certificate of any regular licensed physician stating that Pasteur treatment is necessary, be sent to a Pasteur institute and the State reimburses the town for the expense incurred from the proceeds of the dog tax. We do not have a Pasteur institute in the State, but New York is very accessible and we send patients to New York.

The Surgeon-General. Doctor Holton, how about rabies in Vermont?

Doctor Holton. Well, sir, we had about two years ago a dog who ran through eight or nine towns, in three counties. He bit one child about 10 years old, breaking the arm quite badly. The child was sent to the Pasteur institute and he is alive and well to-day. Under

our laws dogs are licensed annually. Licensing a male costs $1 and a female $4, and that money goes into the fund to pay for the damages dogs do to sheep in the State. At the end of the year any sum left over is turned into the town treasury. The state board of health is empowered to make rules and regulations with reference to rabies in dogs, and our rules and regulations are that a dog suspected of having rabies shall be shot, and, in towns where a mad dog has been known to have been or to have passed through, all the dogs shall be muzzled or kept on their owners' premises secured by leash for ninety days. I do not know whether that is quite long enough. However, we have had no trouble from extension of the disease. Two other dogs were bitten and started on a rampage over pretty near the same route, but when they are at large anybody is at liberty to shoot them, and notices were served by a proper officer—as the sheriff—to every owner of dogs in those towns that they must keep their dogs on the premises, or muzzled, for three months, whether they came into contact with these particular dogs or not. We have had some trouble with dog owners, but if they do not comply with these regulations an officer is sent to arrest and bring them before a justice, when they are fined for noncompliance with the regulations. We had it made a general provision of law that any order of the state board of health that is not complied with, where there is no definite penalty attached, the offender shall be fined not less than $100 nor more than $500; so any order we issue is pretty generally observed, and we have had no trouble since that time. I do not think there have been any other mad dogs in the State for eight or ten years.

The Surgeon-General. We had this matter up for discussion at the last conference, and I think it would be proper to simply act upon the report of this committee. Unless some gentleman has something special——

Doctor Byrd. It seems to me there has not been sufficient emphasis placed upon one phase of the subject, and that is the Pasteur treatment. Many cities with sparse populations or very little hydrophobia do not have institutes for dispensing the Pasteur treatment. The tendency within the last few years—since 1907 especially—has been to bring the Pasteur treatment not simply to the city but home to the individual, and thus reduce the expense of this treatment. That has been done very effectively in Florida, notwithstanding the fact that we have no facilities for preparing vaccine for hydrophobia. But now that the Hygienic Laboratory is sending out vaccine, the question might be, "Does it reach its maximum efficiency until it can be sent in such a way as to go direct to the family physician?" Doctor Harris, of Georgia, has had extensive experience with it in the last year and he has just come in—I think we might hear from him.

Doctor BRACKEN. Mr. Chairman, I am rather disposed to make the point of order, as you have to follow the programme, that we are not discussing Pasteur treatment. We are discussing the prevention of rabies.

The SURGEON-GENERAL. Well, inasmuch as Doctor Harris has been called on, we will hear from him, and then Doctor Anderson can reply, if he has any questions to answer.

Doctor HARRIS. Mr. President, I can not see that I can say anything about the matter, except that it seems to me that the sending of the virus to people's family physicians would probably be the very best way to deal with the problem. As regards laws, I have been impressed since my connection with the state board of health that, unless they meet with popular approval, they amount to very little. A couple of years ago a law was passed in our State requiring a tax on dogs of a dollar, but I am told that it was entirely ignored.

Doctor ANDERSON. I will try to reply briefly to the various questions that have been asked. First, I want to state that a very extensive paper entitled "Facts and problems of rabies," by Passed Asst. Surg. A. M. Stimson, of the Hygienic Laboratory, is now in press and I am sure all of you will be glad to read it when published.

Now as to the questions as to whether we have any instances of rabies following the bite of animals other than dogs, will say that we have a number of reports of rabies following the bites of wolves, skunks, and other wild animals.

In regard to the point raised by Doctor Bracken as to the use of the word "tax," I will say that I think the point is well taken and unless other members of the committee object I shall substitute the words "license fee" in place of the word "tax."

Doctor SNOW. I asked if you could give us any idea how the infection got into California after being absent for eleven years?

Doctor ANDERSON. Well, the first thing is, Doctor Snow, to be sure the infection was not there during this time but unrecognized. The second is, if it was not there unrecognized, in what possible way did it get there? There are several possibilities. It might have been among the wild animals, such as skunks. We have had reports of a number of cases in Arizona of skunks biting dogs and infecting them. Again, it might have been introduced by the dogs of visitors to California. Visitors during the winter form a large part of the population of certain of your cities and many, as you know, carry pet dogs with them; and pet dogs have rabies just as well as other dogs.

The point made by Doctor Woodward in regard to dogs running at large at night is well taken, and I agree with him that the laws or regulations should contain some provision for the impounding of dogs which run at large at night. I believe that answers all the questions.

The SURGEON-GENERAL. We would like now to have expressions of opinion as to the report of the committee. If it is agreeable, we will put it to vote whether the report of the committee should be accepted as it is.

Doctor BRACKEN. Could not the report of the committee be published in a bulletin?

The SURGEON-GENERAL. It was so intended. We are preparing a bulletin on the subject and we thought we would put the views of this conference in that bulletin.

Doctor BRACKEN. Make it a bulletin by itself and have it distributed?

The SURGEON-GENERAL. Yes, sir.

Doctor SWARTS. In seconding that motion I want to commend the committee on its report. It is a most exhaustive and comprehensive one, and a great deal of credit is due Doctor Anderson for putting it in such shape that we can take it as a guide when we are in difficulties (and these difficulties come constantly upon us) to decide for a legislature or a town council what should be done. I second the motion that it should be received and published in the regular proceedings of this conference, and also separately in a bulletin.

The SURGEON-GENERAL. Gentlemen, you hear the motion. Are there any remarks upon it? If not, those in favor of the motion will signify by saying aye.

(The motion was unanimously carried.)

COMPILATION OF HEALTH LAWS.

The SURGEON-GENERAL. The next subject is the report of progress relative to the compilation of health laws by Doctor Kerr.

Doctor KERR. At the annual meeting of the Conference of State and Provincial Boards of Health, held at Washington in 1908, the following motion was adopted:

> That this conference request Surgeon-General Wyman to obtain a codification of the public health laws, national and state, at the earliest possible opportunity.

A copy of this resolution was received from the secretary of the conference on January 28, 1909, and in acknowledging the receipt of the same he was informed that the securing of an appropriation for the purpose would receive consideration.

It was recognized that a compilation of the national, state, and territorial health laws would be of great service to officers engaged in sanitary administration. In order to render it accurate, however, considerable time and labor would be required, and its publication when completed would necessitate a larger appropriation for printing than had heretofore been made, thus involving future Congressional action.

In the meantime it was determined to undertake the compilation requested, and on August 19, 1909, letters were sent to the secretaries or executive officers of the several state and territorial boards or departments of health requesting duplicate copies of the public health laws that had been passed by state and territorial legislatures and that were then active. In response to this request duplicate copies of laws were received from a majority of States and Territories and the District of Columbia. Single copies of the health laws were received from five States, and five States and two Territories did not furnish any copies of their health laws.

Probably through a misunderstanding of the proposed extent of the compilation certain of the collections of laws sent did not include all those in the respective States and Territories that relate to the public health. As a result these collections are being carefully reviewed and efforts made to render them complete.

On account of the non-receipt of laws from Arkansas, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Carolina, South Dakota, and Hawaii, the statutes of these States and Territories on file in the Library of Congress have been carefully searched and copies of the health laws made.

A review of the statutes and copies of laws received shows that many laws directly affecting the public health have been enacted. On the other hand, even a larger number of laws appearing on the statute books have an indirect bearing on public health matters, and while of interest to the sanitarian, are not of direct value to him in his administrative capacity. Some of these may be cited, such as the control of diseases of animals, the care necessary in the handling of oils and explosives, the sale of alcohol and narcotics, and the laws affecting labor.

In beginning the compilation, therefore, it has been deemed advisable to take up first those subjects that are of direct interest to sanitary officers, and regarding which there should be more or less uniformity throughout the country.

The first subject considered was accordingly the organization, powers, and duties of national, state, and municipal authorities. A similar method has been adopted with respect to other subjects, such as the control of contagious and infectious diseases, suppression of nuisances, collection of vital and morbidity statistics; disposition and transportation of the dead, foods and drugs, water supplies and sewage, regulation of tenement and lodging houses, and the regulation of certain occupations.

Special attention is now being given to the collection of morbidity statistics and disposition and transportation of the dead, and special effort has been made to render complete the compilations of laws relating to these subjects. They were therefore selected as topics of

discussion at the eighth annual conference of state and territorial authorities with the Public Health and Marine-Hospital Service, and an analysis of the laws relating thereto will subsequently be presented.

Even with the greatest care some omissions may be made and errors appear in the compilation. It is proposed, therefore, to submit copies of the completed manuscripts or galley proofs to the respective health authorities in due time in order to avoid mistakes, and request will be made for a careful editorial review of the subject-matter.

The American Medical Association has been making a compilation of health laws, and we wrote to the secretary, and he replied that while the association had undertaken this work it was not completed, and its continuation was held in abeyance. We therefore decided to continue with the work the conference had called on us to do. As copies of laws are received they have to be verified by assistants in the bureau from the law library and the important court decisions looked up in the different States. It constitutes a very large work that will take a long time, and it seems to me, although this matter has not been decided, that the publication of these laws should be by subjects in individual volumes rather than in one single volume, as has been done with the labor laws of the United States. That compilation covers about 1,500 printed pages, and I dare say that the health laws and the regulations made under them, and references to court decisions, would make almost as large a volume, if not larger. We have, as I stated in the preliminary statement, just prepared a complete compilation of laws on morbidity statistics and transportation of the dead, and not only the transportation, but the disposal of dead bodies.

Doctor BRACKEN. Will these records be published and distributed soon?

Doctor KERR. Well, the two latter subjects mentioned could be published in the conference transactions or as separate volumes, and they will probably be published shortly after the first of the fiscal year.

Doctor WILLIAMS (South Carolina). I would like to ask whether you want a compilation that would include these laws not under the enforcement of the state board of health, or would you want only those laws that the state board has to do with?

Doctor KERR. We would like to have every law that bears directly upon the health interests in the State regardless of the method of enforcement, and even those laws that apply indirectly to the health interests of the State—we would like to have them. We may not be able to use them right away, but we have endeavored to collect in my division the laws and regulations as they came out in every State and Territory and the important ordinances of the larger cities.

Doctor WILLIAMS (South Carolina). I would like to state, Mr. Chairman, that that was the reason the laws of South Carolina have not been sent in. Those are being compiled and will be sent in.

Doctor HEG. Mr. Chairman, I would like to ask, for information, whether you want only the laws that are actually in force, or enforceable, or also those that are obsolete? Now, we had some laws passed in our territorial days that have been handed over to us as an inheritance. They are still upon our statute books. They are absolutely distinct from our present method of government. They might pass in an emergency, or at least might be used where we did not have anything better, but they are what we call obsolete laws, although they are carried on the statute books.

Doctor KERR. It seems to me that it is very desirable to have copies of all laws relating to public health that have not been repealed, and if they are not enforced, or if it is impracticable to enforce them, that might be stated in a footnote; but they would be of advantage in a compilation of this character. We know that in every State there must be laws that are practically impossible of enforcement, and those laws should be shown in a compilation of this character as an example of what not to do in asking for future legislation.

Doctor HEG. There is another feature I wish to emphasize. I think by our constitution the passage of a law of a later date without a repealing clause repeals not necessarily the entire act that went before but the sections of that act which are affected in the more recent law, and we often do not know until we get a court decision whether a law has been repealed or not repealed. And a number of these acts are still carried. We do not dare to take them off the statute books; but they are burdensome and obsolete, and I do not think we sent you those. My impression is we did not.

Doctor KERR. The advisability of sending in every law, it seems to me, would have to rest with the state health authorities, because in separating these laws and trying to arrange them for publication by sections, where we have a law in one State containing many different provisions we have to separate the different sections and put them in under particular subjects, and those laws will have to be sent back to the state health authorities in order to have them viséed. Certain laws which we have gotten in this collection are to all intents and purposes, so far as we know, still on the statute books, but we have searched in the Library of Congress to see if certain sections of those laws have been repealed, and if they have been we shall have to note that in our manuscripts and call attention to it and have them verified, or if we have overlooked a law we shall have to ask you to supply it when the copy is finally sent to you for revision.

Doctor TOWNSEND. We have some trouble with some of the laws in Connecticut. Section so and so is repealed, or such and such a statute is repealed, and we have to take it to the courts and get a decision

Doctor HARPER. I do not know any work this conference could do which would be more helpful. We all have to suggest laws to our

legislatures and if we know these laws have been experimented with in other States, whatever their experience, there is nothing that would be more helpful to us. The American Medical Association has undertaken the same thing, but as I understand they have given it up. This conference might communicate with them with regard to the matter. If there is any difficulty in getting this information I would suggest communicating with the various secretaries of the state boards of health and have them ask the committee of the American Medical Association to send this information. I paid seventy-five or eighty dollars to a lawyer to get up a complete compilation of our state health laws so as to have them in shape.

Doctor Kerr. I do not want to leave the impression in the conference that the American Medical Association has dropped this work. They have discontinued it for the present, but they have some material and might go on with it. There are several subjects which I think the association has practically completed and made available, for instance the medical practice acts, but it would be obviously unnecessary for us to take up that subject right away, and I question if we have considered in our compilation thus far the medical practice acts on medicine or pharmacy. But those can be taken up by degrees and subdivided, and as we cemplete one subject we can take up another, and so continue until the entire field is covered.

Doctor Bacon. I would say in regard to the work of the committee on legislation that the practice acts were considered first and we have practically all of those in hand and have made a compilation of some few years ago and are keeping it to date. Now, it is only this last year that we have begun this compilation of the health laws. At the suggestion of Doctor Bracken, it is on a broader scale, but we only made a start, and the work has been practically suspended for the time being. Now, one of the main objects of our work has been to help in the formulation of some uniform laws, and we took part in a conference here last winter with the view to success in getting our recommendations for a uniform practice act and other health acts favorably reported on and brought before the national conference of the commissioners on uniform laws. After having made that start and securing the promise of the cooperation of the Civic Federation, we hope to be able to go on with the compilation of some uniform state health laws. Now, there is nothing more to be desired, I think, than the cooperation of all bodies who are working in the same lines and we, I am sure, would be very glad to furnish any information we have, and cooperate with this body and others with the ultimate object of getting such uniformity as may be possible.

Doctor SWARTS. When this question came up the requests from your department and the American Medical Association came to us in the same mail. I was in a quandary as to just what was wanted, whether only the laws directly affecting the public health or those affecting it indirectly also. In that quandary I took the general statutes, which had just been revised, and sent them to the American Medical Association. As you might imagine it was a volume several inches thick, and as they suspended their efforts shortly after, I thought maybe the size of the volume discouraged them. I regretted that the work was being duplicated, inasmuch as it was such an enormous amount of work. If I am correctly informed the American Medical Association, in the compilation of the medical practice acts, is also giving the court decisions as you propose to give the court decisions on the health laws. If we could have all that where it would be available, it would be most valuable to our attorney-generals and solicitors in finding out how these laws may be executed when we have them to enforce.

Doctor KERR. There are two points I would like to bring out. One is with regard to court decisions. In certain States those are impossible to obtain, but in certain other States they are cited in their published laws. For instance, in Massachusetts in their compilation they have these court decisions, and it seems to me that it might be a good plan to include them, but not make an effort to include every court decision, because it would make an enormous amount of matter. Again, the difficulties that have been presented to the different boards have come to us in our studies of this subject, and if the state health authorities in correspondence would explain their difficulties fully, that data could be abstracted and used in this compilation and it would be of assistance to us in completing the work.

Doctor HOLTON. I would like to say to you that there is a journal published in St. Louis for lawyers, in which all the decisions as they come out are published—and I can get the name of that journal when I get home—and within two or three months after they are pronounced from the bench they appear in that journal.

Doctor MCCORMACK. If it is not possible to publish all the decisions, references to them might be made, so that an attorney, for instance, running down a certain subject could get all the data on that subject. And that would occupy very little space.

Doctor KERR. Anybody who visits the Library of Congress and sees the mass of matter there will realize the difficulties of including it all, but if there is an index, such as Doctor Holton refers to, it would be a great help to us.

The SURGEON-GENERAL. I would now like to pass on to the next subject, the compilation of morbidity statistics, which is one of great interest and importance. We are to have some remarks on "The compilation of morbidity statistics by the Federal Government which will be of greatest immediate use to state and territorial health authorities;" Dr. E. G. Williams, commissioner of health of Virginia, has promised to give us a talk on that subject, but there are a few preliminary remarks to be made, and I shall ask Doctor Kerr to make them.

Doctor KERR. The subject of the collection of morbidity statistics has been selected for discussion by the conference on account of its importance and because of the greater effort now being made by the bureau to render such data more accurate and more immediately available. In the prevention of disease public health officials and sanitarians are dependent upon a knowledge of the prevalence and geographical distribution of preventable diseases for the success of their measures. While of fundamental importance, the collection of morbidity statistics in any country has not been entirely satisfactory, and this especially applies to our own country.

Among the reasons for the lack of success in this respect may be mentioned the uneven distribution of the population, the legislative responsibility resting with the various independent units, and the lack of uniformity of laws and the methods of their enforcement.

In accordance with section 4 of the quarantine act of 1893, the Treasury Department is required to collect and publish information regarding the sanitary condition of ports and places within the United States and abroad, and in accordance with section 8 of the law of July 1, 1902, the Public Health and Marine-Hospital Service is required to collect and publish morbidity statistics in so far as possible with the voluntary cooperation of the state and municipal authorities. Under this provision of law effort has been made especially to keep an accurate account of the prevalence and geographical distribution of plague, cholera, yellow fever, smallpox, and other communicable diseases. The complete collection of morbidity statistics of plague and yellow fever within the country has been possible because of the great attention paid to them during periods of epidemics. More or less accurate statistics of smallpox have also been collected through the cooperation of state and municipal authorities, although this has, in a measure, been hampered by the mild character of the disease during the past twelve years.

The importance of a knowledge of the prevalence of these and other communicable diseases is apparent, and this is especially true in a republic such as ours, made up of a confederation of States. It would seem, therefore, that efforts should be made, and the initiative should

be taken in this conference, to bring about greater uniformity of laws with respect to the collection of morbidity statistics and their enforcement. That there is necessity for such effort will be made apparent by the analysis of laws to be subsequently presented.

The national public health service is dependent upon state health authorities at present for its data, and the state authorities are in turn dependent upon the physicians and householders where sickness occurs. Cooperation of all of these agents are accordingly necessary, and in order to render all statistics comparable uniform methods should be established for their collection. It would seem wise, therefore, to make the subject of morbidity statistics a continued topic of discussion in these conferences from year to year, and it would seem desirable to appoint a committee for the purpose, which might work with the view to draft a model act that would be capable of enforcement in the different States and Territories and thus develop and enlarge a registration area for morbidity.

The Compilation of Morbidity Statistics by the Federal Government which will be of Service to State and Territorial Health Officers.

[By Ennion G. Williams, M. D., commissioner of health of Virginia.]

I feel some hesitancy in expressing an opinion as to what the Government should do in the compilation of statistics, inasmuch as I come from a State which does not practice what I am here to preach. Virginia has no law requiring the report of vital statistics, and until recently was without any statute requiring physicians to report the prevalence of the more common contagious diseases. We are hoping, however, for better things, and shall endeavor to carry out, in a somewhat different way, the plans I would here suggest for the compilation of morbidity statistics by the Federal Government.

The character of the statistics of diseases to be compiled by the Government is primarily limited and is chiefly defined by the methods which the Government can employ. I think it is manifestly impossible for the Government to attempt the collection of these statistics directly from the physicians. There are about 80,000 physicians in the United States, scattered in every direction from the seat of government. The mere compilation of the returns from these men, even if they could be secured, would be almost task enough for the Census Bureau, with its army of clerks. It is likewise true that the Government would find great difficulty in securing these reports were the machinery provided to handle and to tabulate them. Experience has shown that the only statistics which can be secured with any degree of accuracy and certainty are those taken directly on the grounds. Even the state health authorities have difficulty in getting the information, though they are much closer to the physicians of the State than the Government can hope to be to the physicians of the whole country. I think our own experience in Virginia illustrates the impossibility of collecting morbidity statistics directly from the physicians without law. In the absence of any statute on the subject, we have attempted, for almost two years, to get voluntary reports from physicians throughout the State and have sent them for this purpose return post cards which had simply to be filled in by the physician at the expenditure of perhaps five minutes' labor once a month. It cost him nothing, it took little of his time; yet we were never able to get reports from more than 60 per cent of the physicians on our list. The local health officers, much nearer to the physician than the state officers, often declare it almost impossible to enforce local laws requiring the report of

contagious diseases. If the local health authorities can scarcely get reports of contagious diseases, and if the State can not get them without legal enactment, the Federal Government, touching the physician from afar, can hardly be expected to do so.

In speaking, therefore, of the compilation of morbidity statistics by the Federal Government, we will assume that the state or local health officers will furnish to the Government prompt and satisfactory returns.

The local health officer, by the statistics gathered by himself in his own community, knows only the diseases that are actually present, but if he knew the diseases prevailing in the territory adjoining his, he might be able to prevent them from coming.

The state health department should keep the local officer informed in regard to diseases prevailing in territory adjoining his in his State. But should his district border on another State he must trust to the department of another State or to the Federal Government. Now, with rapid transportation, it is desirable that a health officer should keep a lookout over a region much beyond the immediate confines of his own district. It is here that the Federal Government can supply the need by publishing weekly or monthly, preferably the former, the prevalence of diseases in every part of the country.

With this information the local health officers can, if not prevent the coming of the disease, at least prepare to cope with it. To be forewarned is to be forearmed. A time when danger threatens is the best time for popular education. The average citizen, who is usually indifferent to preventive medicine, will at such times eagerly read and seek information concerning the nature, causes, and means of preventing sickness. The information that may at such times be imparted to the people is not only effective in the special preventive measures, but the people gain a general knowledge concerning health and disease, and general sanitation is promoted.

This is only one of the advantages of the compilation of statistics by the Government. Probably the greatest value of morbidity statistics will be derived from a study of them from an epidemiological standpoint. We must not forget that epidemiology is still in its infancy, and the possibilities of the full-grown science are perhaps not yet dreamed of by those who are most sanguine.

There has as yet been no careful and systematic study of morbidity statistics, simultaneously gathered and extending over long periods and over large sections of the country.

We know much about the causes of the preventable diseases, particularly those in which a specific micro-organism has been identified. We also know that the spread of these diseases is to a certain extent dependent upon other factors with which we are not familiar. Those other factors are exceedingly important and require investigation. They may probably be found out by the study of an accumulated mass of observations concerning the seasonal, annual, epidemic, and cyclical prevalence of these diseases.

There should also be a collateral study of the relation of the diseases to the attendant industrial, social, and meteorological conditions surrounding the cases reported. Yet, once this information is at the disposal of epidemiologists, it is not a vain fancy to hope that many mysteries may be revealed. The study would doubtless bear fruit of a very practical and useful character. At most, the prospect of good results is not less than that which faced Mathew F. Maury, of the United States Navy, when he started his memorable effort to secure simultaneous observations of the tides and meteorological conditions in all civilized countries, covering a long period. The results were astounding.

From the study of information accumulated in every part of the world came the discovery of the natural laws governing winds, currents, and tides. A new science was born, by which the Government to-day is able to forecast the weather in every section of the country, and is able to say to a nicety from an office in this city what will be the weather in Spokane or in Tampa. Storms are not prevented, but storm

warnings reduce the menace to life and to property. So it may be that epidemics may be forecasted in time to prepare the people and to reduce their ravages, if they may not be checked in their incipiency. Examples of what can come from this field of work are not infrequent where the information already secured is definite and covers any considerable period of time. I have in mind a recent instance of this forecasting which may serve to illustrate the possibilities of the subject. The health officer of the city of Richmond, Dr. E. C. Levy, during the past winter, carefully studied the statistics of measles accumulated in his office during recent years, and, from the curve of high years and low years, reasoned that an epidemic of measles was due in Richmond early in 1910. In February, when there were but five cases of measles in the city, he had an educational leaflet on measles printed. In a few days tho five cases jumped to ten. He at once sent out a warning letter to all physicians of the city telling them that he expected the epidemic and warning them to be on the lookout. His forecast was justified. The city has had 800 cases of measles during the course of about two months, the cases appearing almost in geometrical ratio at two weeks' intervals. Yet, thanks to the warning sent out, only 2 children died, whereas in a similar epidemic three years ago, 35 children died. What was done in Richmond by a study of local statistics may give a faint idea of the far-reaching possibilities resulting from the compilation and study of morbidity statistics by the Federal Government.

The Surgeon-General. We will have a discussion after hearing these papers. The next one will be by Doctor Shumway on "The best methods of securing reports of infectious diseases in a State."

Improvement of Morbidity Statistics—The Best Methods of Securing Reports of Infectious Diseases in a State.

By F. W. Shumway, M. D., secretary Michigan state board of health.

The subject we are to discuss, "The best methods of securing reports of infectious diseases in a State," implies dissatisfaction with present morbidity statistics and prevalence of inferior and inadequate methods. We are not getting the desired results; we know it; and we desire to improve upon our methods as speedily as may be.

The idea of preventive medicine is the one that will prevail this coming generation, and in order best to bring home the facts we shall need more accurate and complete knowledge gained through morbidity and other vital statistics. We are only beginning to discover the relation of certain diseases to occupation; we have only a first hint of the factors that bear on the health of the school child; the maintenance of national vitality rests in a thorough understanding of the physical, social, private, and public factors that enter into individual sickness and an intelligent control of these factors.

I believe my own State, Michigan, is not more greatly handicapped than other States in its effort to obtain precise information on the leading causes of preventable sickness and death. Indeed two of our vital statistics laws (those relating to births and deaths) have served as patterns for other States and prove very effectual; but the Michigan laws governing the reporting of births and deaths do not cover also the reporting of sickness, and their administration is under the department of state rather than under the department of health.

Just before I came away there occurred an instance of inaccurate reporting on the part of tho health officer; a reported death of a case of scarlet fover, which whon we came to compare with the vital statistics division of the department of state, we found to be false. Another instance of a contradictory report on tho part of the health officer showing that he did not understand his business was as follows: Four cases of diphtheria occurred in the household of a person by the name of Taylor, in one of our

large cities, where the health officer is a physician in good standing. The answer "yes" was placed after each of the following questions:

4. Thorough isolation of those sick or infected?

Conspicuous placarding of the premises?

Disinfection of discharges from mouth, nose, and throat?

Disinfection of discharges from bowels and kidneys?

Disinfection of all bedding, clothing, etc., used by the patients and attendants?

Disinfection of the house and contents?

All these precautions, the health officer stated, were carried out as prescribed in our pamphlet on diphtheria; and yet in a footnote on the same report were scribbled these words: "This case spread to Irish family through one man making frequent visits back and forth in night." This of course vitiates the report that the Taylor cases were properly isolated, for they were not. Why did not this health officer then change his answer to that question to "No." The question and fear come up: Are not these questions on our report blanks too often answered perfunctorily, without due consideration of the actual facts and of tho accumulative effect of wrong answers, and wrong information? Our latest annual report (1908) shows that in 88 per cent of the households, tho restrictive measures of placarding, isolation, and disinfection for diphtheria were enforced; yet the same report shows that the annual average number of cases of diphtheria is about 3,147 and that this number has lessened in the past years only about 762. And perhaps this reduction by 762 may be attributed principally to the use of antitoxin as a preventive. Why then, if in 88 per cent of the households everything has been done as it should be, does not the disease decrease? In other words, although the people at large and medical men know that diphtheria is a very dangerous communicable disease, and although the health officers are making enlightened and virtuous reports, in 88 per cent of the households, yet as a matter of fact these reports do not tell the true story, and the restrictive measures are not actually completely observed, although so reported.

The importance of reporting pneumonia is also very little understood and appreciated. During 1909, about 63 per cent of the deaths from pneumonia were not reported as cases by the health officer, and after we notified the health officer of these deaths, about 52 per cent of the 63 per cent were reported six weeks late; and of the 52 per cent, 17 per cent were stated not to have been reported to the health officer by the atteuding physician.

Now, I believe that this laxity, lack of cooperation and inaccuracy which I have instanced in the foregoing is a common experience of every health department, and I havo taken your time to speak in detail of the same the better to emphasize what I believe to be the only cure available at the present time: education of the masses and and state control of health officers; and I believe the latter is an instrument of bringing about the former; that is, public health work conducted directly from the state department instead of through local boards is educational in showing that thorough work brings results.

Of this, the State of Pennsylvania is a speaking instance. The efficiency with which her public health work has been carried on has increased many fold since the state department of health has had control of the health officers and health conditions throughout the State. This, in my judgment, is the solution of the present difficulty. Localities will not pay for officient service and therefore do not get it; the State will pay and will demand it. Local appointees are governed in their official conduct largely by a fear of antagonizing the people whom they serve and the effect of antagonizing them upon their reappointment or popularity as a practitioner, and the necessity of preserving the public health is only too often a remote consideration. The present prevalence of smallpox I believe is attributable to the fact that (1) the disease is so mild as a rule as to excite little fear, and consequently (2) the health officer who is a medical man fears to jeopardize his standing in the community by being strict in

the enforcement of restrictive measures that will lose him patients. State appointees have no fear of local antagonism, and their fearless enforcement of the public health laws is one of the great benefits to be derived from state control of health officers. After a little of such control, the community begins to see that the preservation of the public health pays, fewer schools have to be closed because of laxity in the beginning of an outbreak of scarlet fever or smallpox; the county has fewer bills to meet on account of typhoid fever, etc., and the cooperation of the people, which is essential to all successful public health work, will more speedily be realized.

As hinted in the beginning of these remarks, we are going to need more and more detailed information regarding the causes of sickness, and other information that will enable the public health officials to advise tho people regarding their best interests; and if at the present time our data on the most salient restrictive measures have glaring omissions and contradictions, what can we hope to learn of the niceties of the situation? Worse than nothing. Public health work is expert work, and the people will learn this most readily through its administration by experts who at the present time can be realized only through State appointment and State support.

Another factor which will undoubtedly enter into the improvement of getting true morbidity statistics is the service of trained men. Schools of sanitary science will spring up in every large educational center within the next few years, and from these may be obtained the material for bringing tho health conditions of this country up to the standard where it belongs. The beginning is for these trained men to be employed by the various States to go into the various localities, to furnish accurate and complete statistics, and to obtain the desired results in the most tactful and wise administration of the laws.

The Surgeon-General. Gentlemen, we have one more paper on "The analysis of laws relating to the collection of morbidity statistics," which I think will prove quite interesting, but, I believe, it would be better to have it read after lunch. I think we had better adjourn now until about half past 2, if that is agreeable to you gentlemen.

The conference then took a recess until half past 2.

AFTERNOON SESSION.

The conference was called to order at 2.45 p. m. by the Surgeon-General.

The Surgeon-General. The next paper will be by Doctor Trask on "The analysis of laws relating to morbidity statistics."

Morbidity Statistics in the United States.

By John W. Trask.

Morbidity statistics, as is well appreciated by the members of this conference, are a necessity in public health work. Sanitation being the prevention of disease is dependent for its success upon a knowledge of the prevalence and geographic distribution of the preventable diseases. City, state, and national public health work depend upon it for their successful and intelligent administration.

In accordance with acts of Congress passed in 1893 and 1902 the Public Health and Marine-Hospital Service publishes in the public health reports certain information relative to morbidity. Owing to the lack of uniformity in the laws and practices in the various States, and in many instances to the absence of laws, the information which it has been possible to publish has been more or less fragmentary. The bureau's present interest in this subject is due to a desire to present more comprehensive statistics of the preventable diseases.

The collection of morbidity statistics begins with the report of the physician or other person in the patient's household. For the information of the local health officer having jurisdiction this report is usually made to the city, township, or county board of health. For the information of the State, the local health officer transmits these reports to the state board or department of health as the case may be. The usefulness of the reports does not end at the interstate line, for a knowledge of sanitary conditions within a State is of practically as much importance to neighboring States as to the State itself. For this reason the conditions of morbidity in each State should be known to all the others, for rapid transit has made all neighbors. And, finally, a knowledge of the relative prevalence and geographic distribution of disease in the various States is necessarily an important factor in national public health work.

In the United States the collection of morbidity reports is controlled by the laws of the individual States, the States being the largest political division having jurisdiction in the matter.

It was intended to present at this conference a digest of the state laws in regard to the reporting of disease, but the time available has been too short to allow of a careful treatment of the subject. A tabulation of some of the more salient features of the laws has been made and will be presented. The study will be continued and the digest made the subject of a later report.

A study of the laws has shown that the need for reports of morbidity is appreciated and that health authorities are endeavoring to secure legislation where it is absent, and where it has been secured to improve the value and completeness of the returns.

The States may be roughly classified into (1) those with laws which are enforced, (2) those having laws not enforced, and (3) those having either no laws or, at best, inadequate ones. One of the most noticeable features of existing laws is the absence of uniformity. A similar lack of uniformity seems to exist in their enforcement.

Aside from the zeal with which the laws are enforced, some of them are, without doubt, better laws and more effective than others. It would seem that by taking the good points from each a better law might be drafted than any now in force, which could serve as a model for States in enacting laws for the reporting of disease.

It has been suggested that a committee of this conference might draft a model law, and in addition recommend certain rules of practice in the use and publication of morbidity records, and thus in time bring about a much-desired uniformity.

Status of the requirements of existing laws and regulations for the reporting of disease in the United States.

State.	Health organization.	Reportable diseases.	Reported by—	Reported to—	When.
Alabama	1. State: State medical association is state board of health, and elects state health officer. 2. County: The county medical society is board of health for county and for all incorporated towns and cities therein. (No local board of health except county board of health).	Leprosy, cholera, typhus fever, cerebrospinal meningitis, yellow fever, scarlet fever, bubonic plague, hydrophobia, glanders, smallpox, diphtheria, pulmonary tuberculosis, typhoid fever, chagris fever, beriberi.	Physician	Local health officer	As soon as can be done.
Arizona	1. Territory: Board of health, consisting of governor, attorney-general, and superintendent of public health. 2. County: Board of health, county superintendent of public health. 3. Incorporated cities: Board of health and health officer.	Contagious, infectious, or epidemic disease.	Physicians, keeper of private house, boarding house, or hotel.	Local board of health	Within 24 hours.
		Smallpox, scarlet fever, diphtheria, or other infectious or contagious disease.	Local board of health	Territorial board of health.	Immediately.
Arkansas	1. State: Board of health, consisting of 6 commissioners. 2. County: County judges may appoint board of health. 3. City: City council has the power to establish board of health with jurisdiction extending to 1 mile outside city limits.				
California	1. State: Board of health. 2. County: Health officer appointed by board of supervisors. 3. Incorporated cities and towns of over 500 population: Health officer appointed by board of supervisors of county.	Cholera, plague, yellow fever, leprosy, diphtheritic-membranous croup, scarlet fever, smallpox, typhus fever, typhoid fever, malignant pustule, anthrax, glanders, cerebro-spinal meningitis, pulmonary tuberculosis, pneumonia, dysentery, erysipelas, uncinariasis, dengue, tetanus, measles, chicken pox, whooping cough, mumps.	Physician, nurse, or person having charge of patient.	Local board of health or health officer.	At once.
			Local board of health or health officer.	State board of health	By 5th of each month for preceding month.

Status of the requirements of existing laws and regulations for the reporting of disease in the United States—Continued.

State.	Health organization.	Reportable diseases.	Reported by—	Reported to—	When.
Colorado	1. State: Board of health. 2. Counties: Board of health and health officer. 3. Cities: Board of health and health officer	Smallpox or other diseases dangerous to the public health.	Householder	Local board of health	Immediately.
		Smallpox, cholera, diphtheria, scarlet fever, or other diseases dangerous to the public health.	Physician	Local health officer or board of health.	Immediately.
		Outbreaks of a disease dangerous to the public health.	Local health officer	Secretary state board of health.	Constantly informed respecting every outbreak.
Connecticut	1. State: Board of health. 2. County: Health officer. 3. Town (township): Health officer. 4. Cities and boroughs: Health officer. (A borough is an incorporated town or village.)	Cholera, yellow fever, typhus fever, leprosy, smallpox, diphtheria, membranous croup, typhoid fever, scarlet fever, and other contagious and infectious diseases.	Physician, hotel keeper, etc.	Local health officer	Within 12 hours.
			Local health officer	State board of health.	By 8th of month for preceding month.
		Rabies	Local health officer	Commissioner on domestic animals.	Within 24 hours.
		Tuberculosis	Physicians, officer in charge of institutions, etc.	Local health officer	Within 24 hours.
Delaware	1. State: Board of health. 2. Cities and incorporated towns: Board of health.	Diseases dangerous to the public health	Physician or other person.	Nearest health board or official.	
		Contagious or infectious disease	Local boards of health, physicians where no board of health.	State board of health	
District of Columbia	1. Health officer	Asiatic cholera, yellow fever, typhus fever, smallpox, leprosy, plague, glanders, diphtheria, scarlet fever, measles, whooping cough, chicken pox, epidemic cerebro-spinal meningitis, typhoid fever.	Physicians or person in charge of case.	Health officer	Immediately.
		Tuberculosis in communicable form	Physician or officer in charge of institution.	Health officer	Within 1 week.

Florida	1. State: Board of health and state health officer. 2. County: Board of health in all counties where it is necessary.	Yellow fever, smallpox, cholera	Physician	President state board of health by telegraph at state expense.	Immediately.
		Diphtheria, leprosy, scarlet fever	Physician or person in attendance.	State health officer or state board of health agent.	By first mail.
Georgia	1. State: Board of health. 2. County: Board of health and health officer. 3. Municipalities: Board of health and health officer.	Asiatic cholera, yellow fever, scarlet fever, smallpox, diphtheria and membranous croup, typhus fever.	Physician, head of family, etc.	Local board of health, and in its absence, to the secretary state board of health.	Immediately.
Idaho	1. State: Board of health. 2. County: Board of county commissioners and county physician constitute board of health; county physician is the executive officer.	Smallpox, cholera, plague, yellow fever, typhus fever, diphtheria, scarlet fever, typhoid fever, chicken pox, leprosy, measles, rotheln, whooping cough.	Physician or other person called to attend, head of family, owner or agent of building.	Local health officer	Within 24 hours.
			County physician	State board of health	Quarterly.
Illinois	1. State: Board of health consists of 7 members who elect a secretary. 2. County: In counties not under township organization the board of county commissioners constitutes a board of health with jurisdiction outside of incorporated cities and villages and has the power to appoint a health officer and prescribe his duties. 3. Township: In counties under township organization the supervisor, assessor, and clerk constitute a board of health. 4. Cities and villages have power to appoint a board of health.	Smallpox, diphtheria, scarlet fever, Asiatic cholera, yellow fever, bubonic plague, glanders, anthrax, leprosy	Attending physician or householder.	Local health authorities.	At once.
		The first case of any of the above and also the progress and prevalence of any epidemic disease	Local health authorities.	State board of health	The first case immediately upon discovery and reports of progress of the disease at least weekly.
Indiana	1. State: Board of health of 5 members. They elect a secretary who is the state commissioner of health and becomes a member of the board. 2. County: Health commissioner elected by county board of commissioners. 3. City: Board of health of 3 members appointed by mayor. 4. Incorporated towns: Board of town trustees constitutes board of health and appoints health officer	Yellow fever, smallpox,* cholera, diphtheria,* membranous croup,* scarlet fever,* measles, typhus fever, bubonic plague, leprosy, pulmonary consumption, typhoid fever,* chickenpox, whooping cough	Physicians and midwives or householder or other person having charge of patient.	Health officer of cities and towns or of counties when outside of cities and towns.	Immediately.
			City and town health officer, county commissioner.		By 2d of month for preceding month
			County commissioners	State board	By 8th of month for preceding month all cases of diseases marked * and quarterly reports of contagious diseases.

Status of the requirements of existing laws and regulations for the reporting of disease in the United States—Continued.

State.	Health organization.	Reportable diseases.	Reported by—	Reported to—	When.
[illegible]	1. State Board of health. 2. Health [illegible] Township: Board of [illegible] Board of health [illegible]	Scarlet fever, diphtheria, smallpox, [illegible] cerebro-spinal meningitis, [illegible] plague.	Physician or householder.	Mayor of city or town or clerk of township.	Immediately.
			Mayor of city or town or clerk of township.	Secretary of state board of health.	Within 24 hours.
[illegible]	1. State Board of health. 2. County [illegible] May have board of health and health officer.	Cholera, smallpox, scarlet fever, diphtheria, cerebro-spinal meningitis, and diseases dangerous to the public health.	Physician or householder.	Local board of health or health officer.	Immediately.
		Tuberculosis..........	Physicians and officers in charge of institutions.	Local health officer...	Within 24 hours.
		Infectious and contagious diseases...	Local board of health and health officer.	State board of health..	Without delay.
Kentucky	1. State Board of health. 2. County: Board of health. 3. Cities 10,000 population and over, board of health. 4. Cities less than 10,000 population, and more than 2,500, board of health and health officer.	Cholera, smallpox, yellow fever, scarlet fever, diphtheria, and other communicable and epidemic diseases.	Physicians, head of family, etc.	County board of health.	Within 24 hours.
			Local board of health	State board of health..	At least every 3 months.
Louisiana	1. State. Board of health. 2. Parishes: Board of health. 3. Municipality: Board of health. (The parish in Louisiana corresponds to the county of other States.)	Contagious diseases. (The term "contagious disease," is declared to include diseases of an infectious, contagious or pestilential nature.)	Physician..........	Local board of health..	Within 24 hours.
		Consumption..........	Local health officer....	State board of health..	Quarterly.
		Dengue, yellow fever..........	Local health officer....	State board of health..	Immediately.
Maine	1. State Board of health. 2. Cities and towns: Board of health. (Towns are subdivisions of counties.)	Smallpox, varioloid, diphtheria, scarlet fever, typhoid fever, cerebro-spinal meningitis, measles, membranous croup, whooping cough, pulmonary tuberculosis.	Local board of health..	State board of health..	Promptly.
		Smallpox, diphtheria, scarlet fever, cholera, typhus fever, typhoid fever, cerebro-spinal meningitis, measles, membranous croup, whooping cough.	Householder or physician.	Health officer or secretary of local board of health.	Within 24 hours.
		Tuberculosis..........	Physicians, chief officers in charge of institutions.	Secretary of state board of health.	Within 48 hours.

Maryland	1. State: Board of health. 2. County: Board of county commissioners constitute county board of health and appoint county health officer.	Smallpox, diphtheria, membranous croup, scarlet fever, typhoid fever, typhus fever, measles, mumps, whooping cough.	Householder	Local board of health.	
		In addition to the above, yellow fever	Physicians	Local board of health.	Immediately.
		Smallpox or any other contagious or infectious disease dangerous to the public health.	Local board of health.	State board of health.	Within 24 hours.
		Tuberculosis (pulmonary or laryngeal).	Physician	Secretary state board of health.	Within 7 days.
			Person in charge of hospital or institution, or city, town, or county having charge of patients.	Secretary state board of health.	Weekly on Monday.
Massachusetts	1. State: Board of health of 7 members. 2. Districts: The State is divided into districts with a state inspector of health in each. 3. Cities: Board of 3 members. 4. Towns: Special board, otherwise selectmen act as board of health. (Towns are subdivisions of counties.)	Actinomycosis, Asiatic cholera, cerebro-spinal meningitis, diphtheria, glanders, leprosy, malignant pustule, measles, scarlet fever, smallpox, tetanus, trichinosis, tuberculosis, typhoid fever, typhus fever, varicella, whooping cough, yellow fever, anterior poliomyelitis.	Householders or physicians.	Local board of health, who give immediate notice to school authorities.	Forthwith.
			Local board of health.	State board of health.	Within 24 hours.
		Inflamed eyes in infants	Nurse, relative, or other attendant having charge.	Local board of health.	Within 6 hours.
Michigan	1. State: Board of health of 7 members. 2. Townships: Board of health consists of township board; it appoints a health officer. 3. Cities: Special board of health, otherwise boards consist of mayor and aldermen; appoint health officer. 4. Villages: Special board or the president and council or trustees of incorporated villages constitute a board of health and appoint health officer.	Cholera, pneumonia, tuberculosis, typhoid fever, meningitis, diphtheria, whooping cough, scarlet fever, measles, smallpox.	Householder, hotel keeper, boarding-house keeper, tenant, or physician.	Local health officer, who keeps secretary of state board constantly informed regarding outbreak.	Immediately.
		The above diseases except cholera	Local health officer	Secretary of state board of health.	Constantly informed.
		Inflamed eyes of infants under 2 weeks of age.	Midwife, nurse, or attendant.	Local health officer or physician.	Within 6 hours.
		Tuberculosis	Physician and officers in charge of hospitals and institutions.	Local health officer	Within 24 hours.

Status of the requirements of existing laws and regulations for the reporting of disease in the United States—Continued.

State.	Health organization.	Reportable diseases.	Reported by—	Reported to—	When.
Minnesota	1. State: Board of health. 2. County: Board of health. 3. Townships: Town board is board of health. 4 Cities: Board of health.	Smallpox, scarlet fever, diphtheria, epidemic cerebro-spinal meningitis, anterior poliomyelitis, measles, typhoid fever, tuberculosis.	Local health officer	Secretary of state board of health.	Immediately.
		Smallpox, scarlet fever, diphtheria, measles, epidemic cerebro-spinal meningitis, anterior poliomyelitis.	Physician	Local health officer	Immediately.
		Tuberculosis, typhoid fever	Physician	Secretary of state board of health or local board of health.	Within 1 week.
Mississippi	1. State: Mississippi State Medical Association constitutes state department of public health. 2. County: Board of health and health officer.	Yellow fever, cholera, dengue, smallpox.	Physician	Secretary of state board of health.	Immediately.
Missouri	1. State: Board of health. 2. County: Board of health composed of the judges of the county court and a physician appointed by them.	Smallpox, diphtheria, membranous croup, scarlet fever, typhoid fever, yellow fever, cholera, bubonic plague, leprosy.	County health officer	Secretary of state board of health.	Immediately.
		Contagious diseases	Secretary of county board of health.	Secretary of state board of health.	Quarterly.
Montana	1. State: Board of health of 7 members: secretary is state health officer. 2. County: Board of health consists of board of county commissioners and county health officer. 3. Incorporated cities and towns: Board of health.	Smallpox, diphtheria, membranous croup scarlet fever, cholera, bubonic plague, yellow fever, spotted or tick fever, typhus fever, typhoid fever, cerebro-spinal meningitis, measles.	Householder or physician.	Local health officer having jurisdiction, city, town, or county.	Immediately.
			Local and county health officers	State board of health	5th day of each month.
Nebraska	1. State: Board of health. 2. County: Board of health. 3. Incorporated cities and villages: Board of health.	Asiatic cholera, yellow fever, smallpox, scarlet fever, diphtheria, typhus fever, typhoid fever, measles, ophthalmia-neonatorum, cerebro-spinal meningitis, leprosy, whooping cough, chickenpox, tuberculosis, puerperal fever.	Physician or head of family, school-teachers.	Local board of health	Within 24 hours.
			Local board of health	State board of health	From time to time.

Nevada	1. State: Board of health of 3 members; appoint a secretary. 2. County: Board of health.				
New Hampshire	1. State: Board of health. 2. Town: Selectmen constitute board of health. (Towns are subdivisions of counties.)	Smallpox, diphtheria, membranous croup, scarlet fever, typhoid fever, measles.	Physician or member of family or household of patient.	Local board of health.	Within 24 hours.
			Local board of health	State board of health.	Weekly.
New Jersey	1. State: Board of health. 2. Township: Board of health in each. 3. City, borough, town, and other local municipal government: Board of health.	Cholera, yellow fever, typhus fever, leprosy, plague, trichinosis, smallpox, varioloid, typhoid fever, diphtheria, membranous croup, scarlet fever.	Physician, householder, house owner.	Local board of health.	Within 12 hours.
			Local health officer	State board of health.	Weekly and daily when required.
		Tuberculosis	Physician, chief officer having charge of institution.	Local health officer	Within 12 hours.
New Mexico	1. Territory: Board of health of 7 members. 2. County: Health officer.	Smallpox or other contagious or infectious diseases dangerous to the public health.	Physician, householder, or other person.	If in incorporated city, town, or village, to county health officer; otherwise to justice of the peace of precinct.	At once.
			Justice of the peace	County health officer.	
New York	1. State: Commissioner of health appointed by governor is at head of state department of health: 2. Cities: Board of health and health officer. 3 Villages: Board of health and health officer 4. Towns: Board of health and health officer (Towns are county subdivisions	Infectious and contagious or communicable diseases required by state department of health.	Physician, householder, officers in charge of institutions, hotel keepers.	Local health officer	Immediately.
			Local health officer	State department of health.	Monthly.
		Tuberculosis	Physicians and officers in charge of institutions.	Local health officer	Within 24 hours.
		Smallpox, typhoid fever, yellow fever, cholera.	Health authorities of cities of first class.	State department of health.	Promptly.
North Carolina	1 State: Board of health of 9 members 2 County: Superintendent of health	Smallpox, yellow fever, typhus fever, cholera.	Local health officer, or mayor if in city; otherwise county superintendent of health.	Secretary of state board of health.	Within 24 hours.
		Smallpox, diphtheria, scarlet fever, yellow fever, typhus fever, cholera.	Physician or householder.	Local health officer, or mayor if in city or town; otherwise to county superintendent.	Immediately.

Status of the requirements of existing laws and regulations for the reporting of disease in the United States—Continued.

State.	Health organization.	Reportable diseases.	Reported by—	Reported to—	When.
North Dakota	1. State: Board of health, consisting of president, vice-president, and superintendent of public health. 2. County: Board of 3 members, president, vice-president, and superintendent of health. 3. Incorporated cities: Board of health and health officer appointed by mayor.	Contagious, epidemic, or infectious diseases.	Physician	Local board or township clerk or county commissioner.	Immediately.
			Householders, keepers of hotels and lodging houses, persons in charge of institutions.	Local board of health	Within 24 hours.
		Infectious and contagious diseases	City health officer, township clerk in organized townships; otherwise the county commissioner for his district.	Superintendent of county board of health.	By the 10th of each month for preceding month.
			Superintendent of county board of health.	State superintendent of health.	By the 15th of each month for preceding month.
Ohio	1. State: Board of health of 8 members. 2. City: Board of 5 members. 3. Village: Board of 5 members or health officer. 4. Township: Board of health.	Asiatic cholera, yellow fever, smallpox, scarlet fever, diphtheria, membranous croup, typhoid fever.	Boards of health, health authorities, and physicians where there are no health officers.	State board of health	Promptly
		In addition to the above, plague and other diseases dangerous to the public health.	Physicians, head of family, or owner of building.	Local health officer	Immediately.
Oklahoma	1. State: Board of health and state commissioner of health. 2. County: Superintendent of public health. 3. Township: Board of health consists of township board of directors. 4. Incorporated towns: Board of health consists of town board of directors. 5. Cities of first class: Board of health consists of mayor and common council, who may appoint a city superintendent of health.	Infectious and contagious diseases	Physicians	County superintendent of public health; city superintendent of public health in cities of first class.	Immediately.
			City and county superintendents of health.	State commissioner of health.	On the 10th of each month for the preceding month.

Oregon	1. State: Board of health, which elects state health officer. 2. County: Board of health consists of county judges and commissioners, and elects a health officer. 3. Incorporated cities: Special board of health; otherwise mayor and common council are board of health, and elect a health officer.	Infectious or epidemic disease	Physician or other person.	Local health officer	Immediately.
		Infectious disease	County board of health, city health officer.	State board of health	By 10th of month for previous month.
Pennsylvania	1. State: Department of health consists of a commissioner of health and an advisory board of 6 members. 2. Districts: State is divided into 10 districts, with state inspector in each. 3. Cities, boroughs, and townships: Each has board of health.	Cholera, smallpox, diphtheria, scarlet fever, typhoid fever, typhus fever, yellow fever, leprosy, whooping cough, actinomycosis, anthra , hubonic plague, cerebro-spinal meningitis, chicken pox, epidemic dysentery, erysipelas, German measles, glanders, rabies, malarial fever, measles, mumps, tetanus, trachoma, trichinosis, tuberculosis, pneumonia, puerperal fever, relapsing fever, "uncinaria duodenalis," pellagra, anterior poliomyelitis.	Physicians in cities and boroughs and townships of first class.	Local health authorities.	Forthwith.
			Physicians in townships of second class or borough without board of health.	State department of health.	
			Local health authorities.	State department of health.	Weekly and at end of month for fraction of week.
Rhode Island	1. State: Board of health, 7 members	Smallpox or other contagious or infectious distemper.	Householder or other person in house.	Town council	Immediately.
		Smallpox	Physician or householder.	Town clerk or superintendent of health.	Immediately.
South Carolina	1. State: Board of health, consisting of state medical association and state attorney and comptroller-general, state health officer. 2. Health districts: State board of health divides State into health districts, and in districts where there are no boards of health it appoints subboards of health. 3. Incorporated cities, towns, villages: Board of health, health officer. 4. Unincorporated towns ond villages with populotion of over 100: Board of health.	Inflamed eyes of infants	Midwife, nurse, or person having charge.	Local board of health	At once.
		Tuberculosis, typhoid fever, diphtheria, scarlet fever, smallpox, measles, whooping cough, epidemic cerebrospinal meningitis, leprosy.	Secretary local board of health.	Secretary of state board of health.	By 5th of month for preceding month.
			Phy:icians in incorporated cities and towns.	Local board of health.	Within 24 hours.
			Physicians outside of incorporated cities and towns.	Secretary of state board of health.	
South Dakota	1. State: Board of health elects a superintendent. 2. County: Board of health, one member of which is superintendent of health.	Contagious or infectious diseases	Superintendent of county board of health.	Superintendent of state board of health.	Immediately.
		Smallpox, scarlet fever, diphtheria, measles, cholera, or other disease dangerous to the public health.	Physicians	Superintendent of county board of health.	Immediately.
		Above diseases except measles	Householder	Local health officer	Immediately.

Status of the requirements of existing laws and regulations for the reporting of disease in the United States—Continued.

State.	Health organization.	Reportable diseases.	Reported by	Reported to	When.
Tennessee	1. State: Board of health. 2. County board of health and health officer. 3. Cities 5,000 population and over: Board of health;	Smallpox, yellow fever, cholera, bubonic plague, typhus fever, diphtheria, membranous croup, scarlet fever.	Head of household or physician.	Local health officer	
		Smallpox, cholera, yellow fever, scarlet fever, diphtheria, or other disease dangerous to the public health.	Municipal and county boards of health.	State board of health	1st of each month.
Texas	1. State: Board of health; president is state health officer. 2. County: Health officer. 3. City: Health officer.	Pestilential diseases	Physician	President state board of health.	By telephone or telegraph at state expense.
		Asiatic cholera, bubonic plague, typhus fever, yellow fever, smallpox, scarlet fever, diphtheria, epidemic cerebro-spinal meningitis, dengue, typhoid fever, epidemic dysentery, trachoma, tuberculosis, anthrax.	Physician, householder, hotelkeeper, etc.	Local health authorities.	Immediately.
			Local health authorities.	President state board of health.	Monthly by 5th of month.
Utah	1. State: Board of health. 2. County: The county outside of cities is divided into sanitary districts with a health officer for each district. The district health officers and board of county commissioners constitute county board of health. 3. Cities and incorporated towns: board of health and health officer.	Scarlet fever, smallpox, diphtheria, membranous croup, typhoid fever, whooping cough, measles, chicken pox, pneumonia, tuberculosis.	Local health officer	State board of health	Monthly report by 5th of month.
		Scarlet fever, diphtheria, whooping cough, smallpox, typhoid fever, also any contagious or infectious disease.	Physician or other person caring for sick.	Local board of health	Immediately.
		Tuberculosis	Physician or superintendent of hospital or other institution.	State board of health	Immediately.
Vermont	1. State: Board of health of 3 members; they appoint a secretary. 2. Towns: The state board appoints a health officer for each town, who, with the selectmen constitutes a board of health. 3. Cities: Same as for towns, except that board of aldermen take the place of the selectmen on board of health.	Infectious or contagious diseases dangerous to the public health.	Heads of families or physicians.	Local health officer	Immediately.
		Smallpox, varioloid, Asiatic cholera, typhus fever, yellow fever, and infectious and contagious diseases dangerous to the public health.	Local health officer	Secretary of state board of health.	Immediately.

Virginia	1. State Board of health, with a commissioner of health. 2. County: Board health. 3. Municipalities: Board of health.	Smallpox, Asiatic cholera, bubonic plague, diphtheria, scarlet fever, yellow fever.	Physician	Secretary of the local board of health having jurisdiction.	Immediately.
		Typhoid fever, measles, chicken pox, tuberculosis, hookworm disease.	Physician	Secretary of the local board of health having jurisdiction.	Once each month.
		Smallpox, yellow fever, cholera, typhus fever, bubonic plague.	Local board of health	State board of health	Immediately.
		Infectious, contagious, communicable, or dangerous diseases.	Local board of health	State board of health	Weekly.
Washington	1. State: Board of health. 2. County: Board of county commissioners constitutes county board of health and appoints county health officer. County board of health has jurisdiction outside of cities of the first class. 3. Cities, first class (?) 4. Incorporated cities and towns (except cities of first class): Mayor appoints health officer	All contagious and infectious diseases.	All city health officers, except those of cities of first class.	County health officer	Weekly.
		Dangerous, contagious, or infectious diseases.	Physicians	Local health officer	Within 24 hours.
		The existence of any one of the following diseases: Asiatic cholera, yellow fever, smallpox, scarlet fever, diphtheria, typhus fever, typhoid fever, bubonic plague, leprosy.	Local board of health, health authorities, or officials or physicians in localities where there are no local health authorities or officials.	State board of health	Promptly upon discovery.
West Virginia	1. State: Board of health. 2. County: Board of health and health officer. 3. Incorporated city, town, and village: Board of health and health officer	Cholera, smallpox, scarlet fever, diphtheria, tuberculosis	Physician	Local board of health	Promptly.
			Local board of health	State board of health	At least every 3 months.
Wisconsin	1. State: Board of health, 7 members. 2. Town, village, city: Board of health and health officer. (A town is a subdivision of a county.)	Asiatic cholera,* yellow fever,* smallpox,* typhus fever, leprosy, bubonic plague, diphtheria,* scarlet fever,* typhoid fever,* measles,* rotheln, whooping cough,* cerebro-spinal meningitis,* chicken pox, erysipelas.	Physician, householder, owner, or agent of building.	Local board of health	Within 24 hours.
			Diseases marked * by local health officer.	Secretary of state board of health.	Weekly.
		Tuberculosis*	Physician or householder or person in charge of institution.	Local board of health	Within 1 week.

Status of the requirements of existing laws and regulations for the reporting of disease in the United States—Continued.

State.	Health organization.	Reportable diseases.	Reported by—	Reported to—	When.
Wyoming	1. State: Board of health. 2. County: State board of health designates county health officer in each county; county health officers are under the supervision and direction of state board of health. 3. Incorporated cities and towns: In cities, the mayor and council, and in towns, the president and trustees constitute the board of health. Every board of health appoints a health officer.	Smallpox, cholera, typhoid fever, scarlet fever, diphtheria, or other epidemic or contagious or infectious disease.	County health officer	Secretary of state board of health.	Immediately.
		Smallpox, cholera, scarlet fever, diphtheria, or contagious or infectious disease that is a menace to public health.	Physician	Secretary of state board of health and county health officer.	Immediately, by telephone or by telegraph, or in most expeditious manner.
		Smallpox or any other disease dangerous to the public health.	Householder	Local health authorities.	Immediately.

The Surgeon-General. You will recall also the papers by Doctor Williams, of Virginia, and Doctor Shumway, of Michigan, on the same subject. The subject is now open for discussion by the conference.

Doctor Freeman. Mr. Chairman, at the time of the reorganization of the state board of health, there was scarcely any provision for the reporting of diseases, except smallpox, yellow fever, cholera, and bubonic plague, which were required to be reported at once to the state board of health. We realized the necessity of getting some kind of report, some idea of the prevalence of diseases with which we had to contend, and instituted a system of voluntary reports on return postal cards, which were addressed to the physicians throughout the State, and on the return portion of these cards we had a report blank. All the physician had to do was to fill out and return the card, which had his own name and address on it. On the first call we got replies from about 50 per cent of the physicians of the State. We sent cards again to physicians who failed to respond to the first call, and then again to those who failed to respond to the second, and we got altogether replies from about 80 per cent of the physicians.

These reports are of great value and interest to the state board of health, though of course they can not be used in accurate statistical work because they are so incomplete. We secured from our legislature at its last session a law modeled upon the Pennsylvania law, which requires reports to the town and county boards of health. We have three units in Virginia; the city, the town, and the county. A city is incorporated under a charter, the towns are under charters, while the county has a separate and independent existence. Now, the new law requires that any dangerous infectious, contagious, or communicable disease shall be reported immediately to the county, town, and city health officers, as the case may be. A list of contagious, infectious, and communicable diseases is to be prepared by the state board of health, but it is specified that we may change it from time to time as circumstances may require. Then the county, town, and city health officer is required to report weekly to the state board of health. The plan is to have him send in the original postal card, which he receives from the physician—simply to put these postal cards in an envelope and send them to the state board of health at the end of the week, so that we will be in touch weekly with the situation all over the State. We believe that once the scheme is recognized by the physicians and they are taught that infraction of the law will be followed by prosecution, we shall have a fairly complete and accurate record. I think this explanation is due in view of the fact that Virginia is absolutely unrecognized on any of the maps shown.

Doctor CRUMBINE. My experience in Kansas leads me to say that Doctor Shumway really sounded the keynote of the whole situation, and that is state control of health officers. For several years we have had in Kansas a law requiring the reporting of diseases dangerous to the public health by local county health officers—the county is the unit in our State except in a city of the first-class, which is another unit—direct to the state board of health. But we discovered that the degree of value of the reports rested entirely upon the personality of the local health officer, and as soon as we became convinced that that was true we started out to improve them, and we accomplished that in this way. The former law placed the appointment of a health officer in the hands of the local board of health, the members of which were made up by the board of county commissioners, and thus he was only accountable to the appointing power. In the large majority of instances the county health officer was also county physician to the poor, and that office was let by contract upon competitive bids, and you can readily see what sort of health officer they would obtain in that way. The cheapest man who would do the work (except in some special cases), was appointed health officer. Last winter we had the law amended, whereby the state board of health has power of removal of any health officer who fails or neglects to do his duty.

Now, in addition to that, he is required to give a bond in the sum of $500 for the performance of his duties. We can go into court and sue on that bond. In addition to that the court may inflict a penalty. That was about a year ago. Last winter we set about to send a copy of this law to every health officer in the State, so that they might be advised of the situation, and then we enumerated his duties and gave him a reminder that we expected him to fulfill those duties. Then we began a campaign of bringing them up to the standard by means of our removal powers, and published the names of delinquent health officers, or those who had no reports in when we went to press. By those means, together with personal investigation of delinquencies, after the year had gone by, we had better reports than we ever have had. At our last quarterly meeting I submitted to the board the names of two health officers who had failed to do their duty and recommended that they be cited to appear at our meeting in June to show cause why they should not be removed from office, and in our meeting in June we expect to take action against those health officers. I must say it has brought about results, and I think by that time they will either resign, and give somebody else a chance, or be forthcoming with their reports. Now, another thing we did was to get an opinion from our attorney-general, to the effect that the appointment of health officers on a competitive-bid basis is illegal. Our law states that health officers shall be

selected with regard to their ability in sanitary science; and this was not a competition in sanitary science. So I sent to every board of county commissioners in the State a copy of the attorney-general's opinion, and we have stopped that matter of competitive bids. So we have accomplished those two things during the past year, our conditions have been very much bettered, and I believe we are now getting reasonably accurate reports from our health officers.

Doctor Harper. What body fixes their salaries?

Doctor Crumbine. The board of county commissioners; and in some instances the salary has been raised 500 per cent.

The Surgeon-General. A very important feature brought out by this discussion is the appointment of the local health officers by the state board of health. That plan seems to be growing. I have heard of it quite a number of times, and it seems to me a very important move in the perfection of our sanitary system. There is one gentleman here who I know has some control over the health officers in his State. I will ask Doctor Heg to tell us something about the arrangements in his State. We will not lose sight of the main question, but this is a very interesting question and I think it worth giving a little time to.

Doctor Heg. By law in our State the number and list of reportable diseases are left entirely to the state board of health. The law requires that all such communicable diseases as the state board of health may designate shall be reported. We have revised our list from time to time, and we revised it last January, and now we require a report of those diseases specified by Doctor Trask, together with a number not specified. As to the control of health officers, I wish to say that our scheme of government is somewhat different from that of the Eastern States. Our subdivisions are simply counties and cities. We have cities of various classes, down to towns of 300 people, which are still called cities, and the territory outside of the incorporated limits of a city is in the county. It is under the jurisdiction of a board of county commissioners. Our law requires that the board of county commissioners shall appoint a health officer, who has supervision of the entire territory and direct jurisdiction outside of the incorporated limits of each city, excepting that he does not have supervision over cities of a certain size—that is, 25,000 or larger. It also requires that the mayor of each city shall appoint a health officer. The health officer must be a legally qualified physician. Furthermore, for inefficiency, in the opinion of the executive officer of the state board of health, or for failure to report as promptly as the executive officer of the state board of health thinks it necessary, the health officer may be removed by the executive officer of the state board of health, and can not again be appointed except upon his direction. The law furthermore provides that in any locality where they do not take adequate measures

for the suppression of disease such measures can be taken by the executive officer of the state board of health at the expense of the locality. There is also a penalty attached for failure to obey the regulations of the state board of health. We have had a few removals, and on two occasions we have undertaken to control diseases at the expense of the locality. We deliberately made it so expensive that it was pretty well advertised to all the localities and they do not like to have us take charge. It is one of the best ways we have to make them take action.

The Surgeon-General. I think it would be a good thing if some one could give us some idea of the expense connected with the collection of these morbidity statistics. I was led to make that inquiry by reason of the effort I made to get the State of Louisiana to come into the registration area. A representative from that State called upon me with regard to it, and I gave him a note of introduction to Doctor Wilbur. I found that he had had some conversation with him, and then there was some difficulty connected with getting registration laws through in several States on account of the expense connected with the collection of the statistics. I think they have overcome that in Louisiana recently and expect to get a good registration law through. But that seemed to be the chief trouble at that time, at any rate with regard to Louisiana, and it may be so with regard to other States. So if anyone has information on that point which they could give us I am sure we would be glad to have it.

Doctor Holton. We have in our State a health officer in every town. A city is a municipality by itself. The words "municipality" and "town" are used synonymously. I had that opinion from the attorney-general some time ago; if our law said municipality, it might mean city, or it might mean town. A little over a third of our health officers are laymen, there being no physicians in those towns. A health officer must be a resident of the town for which he is appointed. The state board has the power to remove any health officer without giving any reason for it whatever. We do not exercise that power very often. However, we prefer that charges and specifications be preferred. A hearing is given, and, if the charges are substantiated, we remove him. The law prescribes what the fees of a health officer shall be. For taking down a placard, for examining into nuisances, or anything of that kind, the health officer shall have the same pay as a physician would get for a visit. Now, in some towns it is a dollar a visit, and in some two dollars, so it makes a difference where a man lives as to what his salary will be. Some get a thousand dollars annually for their services.

We have trouble getting reports of births because the law requires that the family shall have thirty days in which to name the child, and the town clerk does not report because he is waiting to get the

name. The deaths have to be reported by the attending physicians or some member of the family. There is a fine of $10 if they do not report them to the clerk of his town, who in turn reports to the secretary of the state board of health. Nobody can be buried in the State without a burial permit, which states were he was born, where his father and mother were born, and everything required in a burial certificate, so there is no trouble about getting that. A burial permit given in any one town is good in any other town. So a health officer can give a burial permit in one town for a body which is to be buried at the other end of the State.

Doctor HARPER. How many health officers have you in Vermont?

Doctor HOLTON. Two hundred and forty-six.

Doctor HARPER. Is the county the unit?

Doctor HOLTON. No; the town is the unit. A county or township is the same as a municipality.

Doctor TOWNSEND. With regard to collecting morbidity statistics, I do not think it entails extra expense in Connecticut. We have a health officer in every town and city of the State who reports monthly to the state board of health, and about the only extra expense is the cost of postals used by the physicians. The physicians receive 25 cents for each birth and death reported, but get no compensation for reporting contagious diseases. There has been considerable opposition to the latter. They claim that they should be paid; but it has been maintained that it is within the police power of the State to require physicians to give that information. Some years ago Doctor Worden, as a member of the state board of health, went to the expense of getting a decision from the supreme court of the State in order to settle the matter with the physicians who objected. He had a case of diphtheria under his care which he refused to report to the local board of health; he was promptly arrested and fined in the Bridgeport police court. He appealed to the superior court, and was tried by jury on a plea of not guilty. The jury returned a verdict of guilty, and he appealed to the supreme court for error in the charge of the judge. The contention was, of course, that the Constitution forbids that any person should be deprived of his life, liberty, or property without due course of law; that compelling a physician to report these diseases was taking his time and labor, as well as his professional knowledge, which is his property—the only property some of us possess; and, secondly, that compulsory labor is an infringement on the liberty of the physician. The State maintained that the legislature, in passing this law, was exercising its power and duty to protect its citizens from exposure to fatal diseases. The court found no error in the ruling of the lower court, and this has been our law ever since.

Doctor HILL. The last subject discussed was a most important one—the duty of the physician. Scratch a Russian deep enough and you always find a Tartar, they say. If you scratch deep enough into this matter you will find it is the practicing physician who is giving most of the trouble. In view of that, and because the basic question in public health is the reporting of diseases, a committee of the American Public Health Association was appointed this year—another member present is Doctor Anderson—to go to the American Medical Association and present to it the proposition to change its principles of ethics so as to include as one of the basic duties of a physician the reporting of diseases. And it seems to me that strikes at the root of the whole matter. It will, I think, do away with compelling physicians by process of law to report diseases. The idea is to cut from under any physician, who has any lingering doubt about the ethical propriety of reporting diseases, that one excuse. At least that is the way we look at it, and that is the theory on which we are going to make the fight with the American Medical Association, and have it settled one way or the other.

Doctor BRACKEN. I am amused by Doctor Hill's new responsibility. I used to have to be called on to give the morbidity statistics, but Doctor Hill is now our epidemiologist, and he begins to find how difficult it is to get morbidity statistics. He had to collect morbidity statistics of typhoid fever in Minnesota a few weeks ago, and also of infantile paralysis. I would like to have him tell you his experience.

Doctor HILL. In the city of Minneapolis last year there were on the records less than 100 cases of typhoid fever; of those about over one-half were deaths, indicating nonreport of at least four-fifths of the cases. This year we found very much the same conditions; yet it was a matter of common knowledge that typhoid was very abundant. Finally a letter was sent out to the 350 physicians in Minneapolis asking them to report cases since the 1st of January. It was a matter of great public interest at the time, not only to the public health, but in every way. About one hundred and seventy odd reported back the cases they had had; and even some of these merely said, "You can find my cases by looking over the records of such and such a hospital," i. e., did not give reports at all. Again, we sent out a schedule of questions regarding poliomyelitis, carefully arranged, so that all the physicians had to do was to fill in the blanks and remail. We sent these to some two thousand physicians in the State, i. e., every physician we could find on the records, and five men out of nine failed even to acknowledge receipt of the schedules, although we sent with them stamped and addressed envelopes, all ready to come back. Now, that is an illustration of the attitude of physicians on this question. While the American Medical Association is trying to secure for medicine its proper leading place in public

hygiene, why not try to see that the profession shall perform its obvious everyday duty also? It is a great mistake to allow the medical men upon whom such failures rest rank equally with those men to whom the successes are due. We think that the American Medical Association by making the reporting of public health statistics a matter of professional ethics will aid us in getting somewhere near the basis of the subject.

Doctor SUMNER. I have been living over my experiences while listening to the remarks that have been made. Fortunately for me, having just come into the state office, I took with me my wife, who had been my private secretary in the city board of health of Waterloo for eight years. One of the first things I said to her on the first morning of my advent into the secretaryship of the state board of health was, "Let us try now to get, if possible, some reports, and get them regularly." She at once prepared a circular letter, and had it printed, and we set two or three stenographers to work addressing those letters and they were sent throughout the State. In the meantime I had her go over the death certificates for 1909, and for the first time during my experience of many years in the practice of medicine in Iowa, I was able to learn the number of deaths in the State of Iowa. In the year of 1909 there were 19,554 deaths, of which 1,597 were from tuberculosis. In the month of November of last year we had the smallest number of deaths from tuberculosis during the year, which was 84. The largest number of deaths by months for the year was in April, 1909, which was 160. In the month of January of this year we had 1,854 deaths in the State, of which 116 were from tuberculosis, and 113 of these were pulmonary, while the other three were from other forms. In February we had 1,700 deaths, 113 being from pulmonary tuberculosis and 2 from other forms. In March we had 114 from tuberculosis, 111 being pulmonary. We are now just beginning to issue our new monthly report sheet of deaths, in which on the right-hand side is recorded the number of deaths in each of the 99 counties of the State, and then the prevalent diseases are recorded at the top, beginning with typhoid fever. The number of diseases in each county are taken from the death certificates, filed with us at the end of every month. Over on the right-hand side we give an enumeration of those who died prior to 1 year of age, those between 5 and 10, between 10 and 20, and so on.

The SURGEON-GENERAL. Pardon the interruption, Doctor. You are dealing with mortality statistics. What we have in mind is morbidity statistics.

Doctor SUMNER. Thank you. In connection with that I will say that we have placed two large maps on boards, and by means of colored tacks, pink, yellow, and other colors, represent the different kinds of diseases; and in connection with this we have sent over the

State postal cards to all the health officers in the State to send in daily reports, and then we communicate with the locality. For smallpox we put up a yellow tack.

The SURGEON-GENERAL. Have you any law requiring them to send in those reports?

Doctor SUMNER. It is only a rule of the state board of health. I merely mentioned our work by way of explanation and to show that we are just trying to get uniform statistics of causes of death, the reporting of diseases, and number of diseases in a locality. All of this is therefore very interesting to me.

Doctor SHUMWAY. I believe, Mr. Chairman and gentlemen, that there is a good deal of force and truth in the remarks of Doctor Hill. There are 1,600 health officers in Michigan. Between seven and eight hundred of those are physicians, and I have more trouble with those physicians not sending in accurate reports than I have had with all the laymen who are acting as health officers. Now, I am not criticising the laymen as health officers, for the reason that they have not the scientific knowledge necessary to make good health officers. They are quite active in their work and are better on reporting than the physicians. Again, I think the question of compensation is important. We have realized that in our State since the passage of our tuberculosis law, where we allow the physician 50 cents, we have more complete detailed reports on tuberculosis than we get on any two or three of the other reportable diseases. And I believe firmly that there should be dissemination of education among the physicians themselves, and where the appointive power rests in the local authorities, as it did prior to two years ago, as it does to-day in some places, that local board is absolutely in power. Now, to illustrate what I mean by that: We as scientific men, state boards of health, and physicians say to the public that certain conditions are dangerous and certain restrictive measures are to be carried out. We prescribe that to the health officers. But they are opposed sometimes by the local boards who are not composed of medical men, but of old farmers or exfarmers who know no more about health matters or sanitary matters than a hog knows about Latin; they can say to the health officer, when a spirit of economy comes over them, "Now, we do not believe that such and such is necessary for the public health. We don't think it necessary." And the state board of health, up to two years ago, was powerless to prevent that, until a law was passed giving the state board more power; but I say until we can get the appointive power of the local health officer vested in the state board of health our statistics are going to be extremely faulty, and necessarily must be from the nature of their collection.

Doctor SWARTS. While holding no brief for the physician, I would like to ask Doctor Hill if he would expect a report from typhoid

fever in its last stages from a health officer who happened to be an undertaker? [Laughter.]

The SURGEON-GENERAL. I think we all have a great admiration for the system in vogue in Pennsylvania during the last few years. Doctor Dixon was to have been here, but was called away unexpectedly and sent his regrets. But we have a very worthy representative of Pennsylvania in Doctor Batt, and I would like to hear from him.

Doctor BATT. In the first place, we feel that we have a very definite and effective law, but our experience in the last five years has proved to us one thing, and that is that we need a good deal more than law to get morbidity reports. You can write pages on the statute books and add penalties to those statutes, but unless you have a sanitary establishment, perfectly organized, ready to get back of it, to take proper sanitary precautions and restrictions, to enforce the quarantine, school exclusion, and disinfection, which those cases are entitled to, sooner or later the best law in the world is going to fail in securing morbidity reports. In other words, physicians will not continue to report communicable diseases if they believe these reports are simply for tabulation purposes, but the minute they find that they are for practical purposes and that the reports are followed up by quarantine, placarding, school exclusion, disinfection, etc., then they gradually have created behind them a public sentiment which does just as much to secure the reports of communicable diseases as the law does. It does not do everything, but it helps a whole lot. Now, I believe the fact that we are getting fairly successful morbidity reports in Pennsylvania is owing to the 800 health officers in the State of Pennsylvania appointed by the commissioner of health, and what is even better, who are paid by the commissioner of health out of funds appropriated by the State of Pennsylvania. A report made by a physician in a rural district, which districts cover all our townships outside of our incorporated municipalities, does not come to the state department of health directly, but to the local health officer of that district, and is treated exactly as a case of communicable disease would be treated in one of the larger municipalities. It is the duty of the health officer to make a record from the card received from the attending physician and he sends a transcript of that to the county medical inspector, who is his immediate superior officer. The original card is then restamped and sent to the state office. He then proceeds to carry out his instructions, which depend entirely upon the character of the case.

The SURGEON-GENERAL. We are speaking now of contagious diseases. Does your law apply only to them, or to other than contagious and infectious diseases?

Doctor BATT. No, sir. We have specifically enumerated in our sanitary code which diseases shall be so treated; but the state commissioner of health may add to the number without waiting for legislative action.

The SURGEON-GENERAL. Is malaria one of your reportable diseases?

Doctor BATT. Yes, sir. We have had on our lists 29 diseases. Since that law was passed and in conformity with the compilations from your office the commissioner of health has further extended that list to include pellagra, hookworm, and anterior poliomyelitis. These are not yet written in the statute, but we have 29 diseases in the legislative code.

We have just seen what becomes of these reports. The health officer then applies whatever measures are necessary, posts placards in certain cases, places a limited quarantine on or notifies a school if there is danger, and upon completion of the case disinfects the house, removes the quarantine, etc. Every step taken in the case he is required to report by sending to the state office a card of different color, until the case is finally discharged. So there are three cards sent us in all cases, and additional notices must be sent of exclusion of children from school, and of readmission of the same. These cards are compared in all cases and show the absolute disposition of each, and are a check upon the health officer's voucher when he comes to be paid. When I say that we think we have a fairly satisfactory system in operation there, the question might arise, "Why do you think so?" Well, we go back and we carefully check our morbidity returns first with our death returns.

To see if any particular death has been reported, aside from the individual death returns, we check up our case rate with our mortality rate—total number of deaths in the State from certain diseases and the total number of cases reported—and we can tell from the average death rate fairly well whether we are running close to the proper average. We have a free distribution of antitoxin for diphtheria, and when a physician receives that antitoxin he is required to sign a slip, and we check that up against our morbidity reports to see whether the physician has reported the case.

Doctor BRACKEN. Have you compared your mortality and morbidity rates in typhoid fever?

Doctor BATT. I was just coming to that, because typhoid furnishes one very good example. From the text-books on typhoid we are led to believe that there is a mortality of 8 to 10 per cent. We followed that up and found it held fairly good in our large cities, with hospital accommodations and abundant nursing facilities, but it is entirely too low when applied to typhoid fever scattered over 45,000 square miles.

Doctor BRACKEN. Your mortality is higher, then, in the country than in the city?

Doctor BATT. Fifteen per cent or higher. As you go down the scale of population from our larger cities to our rural communities the mortality rate steadily advances. I only mention these facts to show you how we check up our morbidity reports. The state department of health having absolute control of the rural health officers is one of the corner stones of this work.

The SURGEON-GENERAL. And the fact that you pay them, too.

Doctor BATT. The commissioner of health appoints, discharges, and pays them.

Doctor BRACKEN. Tell us how the rest of us can get two or three million dollars a year.

Doctor BATT. We do not get two or three million dollars a year. But I can tell you how you can help to get it, if you can not actually get it. Start in one section of the State and make yourselves known. As at present organized, the state boards of health, so far as 90 per cent of the people are concerned, are a myth. Evidence of their existence is so rare that to the people on the farms and in the small villages a state board of health is an unknown quantity. Now, in Pennsylvania our men are all over the State. They inspect our streams for nuisances——

Doctor BRACKEN. Do you mean to say that there are not any local——

Doctor BATT. They are not only local—many stream inspectors go around quite a distance—but the whole State is constantly covered by local inspectors. They inspect the dairies, they look after the sanitary condition of schoolhouses, and in addition to that disinfect private houses and report cases of disease. So that the state department of health is constantly being brought in contact with the people, and the people are beginning to look upon it more as a reality to help them in their troubles. And a law, while it may be essential, will not accomplish much unless the organization is there to apply in each one of these cases just the restrictions that modern science has shown to be necessary.

Doctor SHUMWAY. Doctor, what territory does your health officer cover?

Doctor BATT. The commissioner of health has jurisdiction throughout the State. But he is not supposed to go into an incorporated city or borough except through negligence of local authorities. But outside of them there are 1,473 townships. We have 800 health officers and the sanitary district assigned to each man is an arbitrary division of territory. One man may have two or three townships in his district, depending upon its geographical location.

Doctor SHUMWAY. What do you pay them?

Doctor BATT. Well, it depends entirely upon the number of communicable diseases in their districts. We pay them in some cases per diem and in some cases per hour.

Doctor SHUMWAY. What would you think the average might be?

Doctor BATT. I can not definitely answer that. I think the smallest amount a health officer in our State gets directly from the State—he may often get some more from a borough or municipality—approximately $250 a year. But we have a number of physicians who have retired from practice and live on their compensation as county medical inspectors. Of course some of these are in charge of dispensaries, and some are getting a couple of thousand dollars a year. There is no established pay roll. A health officer may get $20 this month and a larger compensation next month.

Doctor SHUMWAY. But they all get paid from the state office?

Doctor BATT. Absolutely.

Doctor SHUMWAY. You have an appropriation that covers this?

Doctor BATT. Yes; $3,000,000, covering a period of two years and including tuberculosis work.

The SURGEON-GENERAL. Gentlemen, I am sure we are all very much interested in Doctor Batt's discussion of the methods in Pennsylvania. This is a matter which I think ought to be considered from year to year until the whole thing is thoroughly settled. I propose, with your full concurrence, to appoint a committee of this conference to consider certain subjects connected with the matter. For instance, what diseases shall be reported, improvement in the laws and regulations, methods of collection, and I would like to appoint a committee to consider those subjects, consisting of Doctor Shumway, Doctor Williams, of Virginia, Doctor Richardson, Doctor Snow, and Doctor Crumbine. This committee could take these subjects under consideration, and I would like to put them in relation with Doctor Trask, who is the officer in this bureau who has immediate charge of these matters. I would like to have you get together with him, and I think we could work out some interesting and profitable results.

DISPOSAL AND TRANSPORTATION OF THE DEAD.

The SURGEON-GENERAL. The next subject for discussion is the disposal and transportation of the dead. I know you have considered this subject in the conference of state and provincial health officers, but we often get requests from relatives of people who have died abroad, and the method of enabling them to get the body home is rather difficult. I shall ask Doctor Cofer, in charge of the quarantine division of the bureau, to open the subject and show our difficulties. We do not want to discuss the thing from an academic standpoint,

but to get some idea from you as to how to conduct hereafter affairs of this character.

Doctor COFER. I have here a large package containing letters received by the bureau upon this subject, but I will only read the last one received, which will serve to illustrate the points which the chairman desires to be brought before you. The majority of these communications, together with the answers made to them, pass through departmental channels, which occasions considerable time and trouble to a number of different persons. I will read a telegram received from the Department of State, dated April 16, containing a request for a permit for the removal of the remains of the French minister to Guatemala from Guatemala City to France via New Orleans and New York:

This department is in receipt of a telegram, dated the 15th instant, from the American minister at Guatemala City, in which he says that Mr. Pierre Jean Babtiste Ernest Auzepy, minister of France to Guatemala, died of heart disease aggravated by the altitude of that place; that the French legation there desires to know what formality must be observed in the United States in removing the body to France via New Orleans and New York or via New Orleans direct to France; that as the widow is accompanying the body alone the French legation wishes to relieve her as much as possible from painful formalities, and that if this is not possible, she will be obliged to take a much longer route via Costa Rica to France. The department requests that you will inform it at your earliest convenience what can be done by the Treasury Department to facilitate the transit of the remains of the deceased minister through the United States by either of the routes indicated in order that the American minister's telegram may be answered as speedily as possible.

This telegram is signed by the Acting Secretary of State. Now I will read the answer we were compelled to make to this communication on account of the regulations as they now exist. The answer is addressed to the honorable the Secretary of State and signed by the honorable the Secretary of the Treasury. It is dated April 18:

The department is in receipt of your telegram dated April 16, 1910, requesting information by which the transit of the remains of the late minister of France to Guatemala may be facilitated while en route to France via the ports of New Orleans and New York. In reply I have the honor to state that it will be necessary for the body to be prepared in accordance with the following rules adopted by the conference of state and provincial boards of health of North America held in Baltimore in 1903, as follows:

"If the body can not reach its destination within thirty hours from the time of death, it must be prepared for shipment by arterial and cavity injection with an approved disinfecting fluid, washing the exterior of the body with the same, and enveloping the entire body with a layer of cotton not less than 1 inch thick, and all wrapped in a sheet securely fastened and inclosed in an air-tight metal-lined box."

A certified certificate in duplicate should accompany the body from Guatemala City to New York, the said certificate setting forth the fact that the requirements above stated have been carried out. One copy of this certificate should be presented to the quarantine officer at the port of New Orleans and the other copy used when necessary during the transit of the body between the quarantine station at New Orleans and New York City.

There should be another certificate duly certified and made out in duplicate setting forth the time, place, and cause of death.

It is suggested that the above-named certificates be certified by the American consul at Guatemala.

This information had to be telegraphed to Guatemala City, and we do not know whether or not the remains of the minister were sent through New Orleans and New York or whether direct. The cause of death in this case was a simple heart disease, and the transfer of the remains should have been handled in a less complicated manner.

On account of sentimental and other reasons dead bodies are not infrequently shipped from one point to another, and such transportation may at times become an interstate matter. Dead bodies are likewise shipped from time to time from foreign countries, and upon arrival at one of the quarantine stations must be transshipped to their destination, which may be in some other State or Territory.

Shipment of dead bodies from foreign countries are made with the assent of the consul at the port of sailing, but bodies dead of quarantinable diseases are not allowed to be shipped. A body may also be refused shipment by the consul under the provisions of paragraph 17 of the United States Quarantine Regulations to be observed at foreign ports, which is as follows:

Any article presumably infected which can not be disinfected should not be shipped.

Provision is also made in the above-mentioned regulations for the care or disposal of bodies of persons who have died at sea, paragraph 50 reading as follows:

The dead body should be enveloped in a sheet saturated with one of the strong disinfecting solutions without previous washing of the body and at once buried at sea or placed in a coffin hermetically sealed.

On arrival at quarantine special provision is made for the disposition of bodies of persons dead of quarantinable diseases, paragraph 86 of the Quarantine Regulations reading as follows:

86. The body of no person dead of quarantinable disease other than yellow fever shall be allowed to pass through quarantine until one year has elapsed since death. Such bodies must be transported in hermetically sealed coffins, the outsides of which have been carefully disinfected.

In the case of the bodies of such persons as may have died of quarantinable disease other than yellow fever on the voyage or upon arrival at quarantine, cremation should be resorted to if practicable and consented to; if not, the body should be wrapped without preliminary washing in a sheet saturated with a solution of bichloride of mercury 1:500 and buried, surrounded by caustic lime.

It will be seen from this regulation that no body dead of a quarantinable disease, except yellow fever, can pass quarantine, and the question of their transshipment does not arise. Requests may be received, however, for the transshipment of bodies of persons dead of communicable diseases, such as tuberculosis, typhoid fever, and

diphtheria, and the constitutional maladies. Such demands are urgent, and in most cases must be complied with.

It is recognized that when a body is carefully prepared for shipment there is practically no danger to the health of the communities through which it passes, and it must be admitted that the liability to infection from this source has been somewhat overrated. Notwithstanding this fact, the greatest care has been taken in arranging for the transhipment of bodies from one State or Territory to another, and in cases where it was known that a body was en route from a foreign country arrangements have been made with the authorities of every State through which the corpse was expected to pass. This method, while safe, is time-consuming and might result in serious inconvenience to the relatives traveling on the same ship, as well as those at the point of destination. In order to meet this contingency, provision should be made by regulation, or otherwise, for the transshipment without interruption across state lines of bodies arriving at quarantine stations and which have been inspected and carefully prepared for transshipment under the supervision of the quarantine officer.

This matter is brought to the attention of the delegates of the conference for their consideration as to the advisability of making a regulation for the transshipment of dead bodies from quarantine stations. It is believed by the bureau that this might be done, and that by requiring a certificate from the quarantine officer to the effect that every precaution had been taken the body could be allowed to proceed to its destination.

The SURGEON-GENERAL. I was in your meeting yesterday and heard the closing remarks and resolutions about bodies—some report about the disposal of the dead. Doctor Bracken has been asked to say something upon this subject. You evidently came to some conclusions at your conference, Doctor, as to regulating the transportation of the dead, and we would like to have you give us here, in brief, what your conclusions were.

Doctor BRACKEN. Mr. Chairman, I will try to be brief. Prior to 1897, as I understand it, there were no shipping regulations relating to the transportation of the dead. In that year railroad officials came to me (it was my first year as state health officer) and asked me if our state board had any regulations. I had to tell him no. A movement had been made to arrange for transportation regulations by efforts of mine, and in 1895 regulations were first put in effect—that is, advisory regulations that could be used by state boards of health throughout the country—and these were acted upon in 1897 by the meeting of state and provincial boards of health at Nashville, Tenn. These regulations were somewhat cumbersome. We tried to

modify them, and did so to some extent, in 1902. The regulations that were adopted in 1902 have been the guide for many of the States up to the present time. An attempt was made to modify these regulations by action of this meeting of the conference, and we failed—failed because some are still holding to the old ideas of dangers that do not exist—and the committee has been instructed to bring in a report based on scientific knowledge for the meeting next year. Of course, regulations passed by the conference are only advisory, or to be used as a basis for action by the different States, but it does help us to secure uniformity of action. Now, my friend, Doctor Swarts, who is very much bored when the subject of transportation of the dead comes up, lives in a little State where they can travel from one end of it to the other by horse if they want to. Unfortunately I live in a State that has some size, and the agents of the railroads tell me that the possibilities of shipping and the facilities for shipping under the regulations, cumbersome as they are, have increased more than a hundred per cent since the regulations went into effect. Before they had any regulations it was so annoying to arrange for shipment even for reasonably short distances that few ever attempted to do so, while now shipments are very common indeed. We feel that this Bureau can be of great help in formulating regulations relating to interstate traffic. Of course, our regulations can only relate to state traffic, but our regulations can be made somewhat uniform. The only lack of uniformity now is that some States have not agreed to make over our somewhat unnecessarily rigid regulations. They broke away, and I think that is a mistake, because when they break away it establishes confusion. I think that is about all I can say on the subject.

The Surgeon-General. We are very glad to have these suggestions made, and we will consider them to see what we can do toward eliminating confusion on the subject. If the Treasury Department makes interstate regulations the States will be supposed to enforce them. Of course, they can enforce additional restrictions, but we can perhaps agree on uniform measures.

Doctor Bracken. I would like to suggest that Doctor Batt is chairman of that committee to consider these regulations further, and it might be worth while to confer with him.

Doctor Crumbine. Mr. Chairman, I would like to say just a word, which does not relate to the question of regulations, but it seems to me it might be a proper place to speak a word on a matter which is quite confusing to people who ship dead bodies, and that is the difficulty in having these bodies checked through to destination, and it seems to me that the Public Health and Marine Hospital Service might be of great benefit to the States if it could possibly require shipment through to destination. For instance, in Kansas we want

to ship to New York City. The body is held up at St. Louis; it can then go as far as Pittsburg, but not through, and where there is a change of roads there is a delay of a day at those towns, and it is exceedingly distressing. If there were United States regulations and all the States agreed to them, they would be obliged to let them go.

Doctor BRACKEN. I think it would be well if we had facilities for expressing bodies, and various attempts have been made to have the express companies get into line, but I think the trouble is that there is an agreement between the railroads and the express companies. The railroads are a little inclined to break away from it, but the express companies are not. If they would make us a good rate, it would be a far safer way.

Doctor BROWNING. That brings up the question I was going to ask. Is there not another factor concerned besides the medical regulation? I think the baggagemen have their rules. Now, there are three distinct routes of transportation companies from east to west, and it just occurs to me that it might be worth while——

Doctor BRACKEN. The baggagemen's associations have been in touch with us ever since 1895, and whenever we pass regulations—they were in conference with Doctor Batt here on this point—they know what our regulations are and are willing to be governed by them—and the undertakers, too, the National Undertakers' Association.

Doctor HEG. Mr. Chairman, I would like to call attention to the shipment of bodies from Alaska by boat to Seattle, which are then shipped through. They come down from Alaska almost any old way, and I would like to have you bear that in mind in drawing your interstate regulations.

Doctor SNOW. Does the quarantine service make any exception in the case of cremated bodies?

The SURGEON-GENERAL. We certainly would.

Doctor SNOW. Well, I have been asked that question in California.

The SURGEON-GENERAL. There would be no objection on our part. We would not consider such remains infected.

Doctor SNOW. I understand that on principle, but as a matter of law I wondered whether I had the authority to except cremated bodies under these rules.

Doctor BRACKEN. A cremated body is not a body.

The SURGEON-GENERAL. Doctor Kerr will give a synopsis of laws relating to disposal of the dead, to be followed by Doctor Anderson's report on what is to be considered a good disinfectant.

Doctor KERR. It was stated this morning that an analysis was made of these laws. It was prepared with the idea of reading it, but I shall just read the headings and have the complete paper appear in the transactions.

Analysis of Laws and Regulations Controlling the Disposition or Transportation of Dead Bodies.

By J. W. Kerr.

On account of the difficulties arising in connection with the transshipment of dead bodies at quarantine stations and because of the desirability of uniform regulations to control such practice, an analysis of the laws and regulations relating to the disposal of dead bodies in the several States and Territories and the District of Columbia was undertaken. That the subject is important is shown by the fact that practically all of the States and Territories have laws or regulations controlling the disposition or transportation of dead bodies, and the prominence given to it by various conferences of sanitary authorities.

In the analysis made, consideration has been given to the following topics: Requirements as to permits for the disposal of dead bodies; regulation of burials; restrictions in cases of the infectious diseases; regulations of the time of burial or other disposition; minimum depth of graves; requirements regarding the disinfection of dead bodies; control over disinterments; powers with respect to transportation of dead bodies; the uniformity of transportation rules in the several States and Territories; the licensing of undertakers; and regulations as to embalming fluids.

PERMITS NECESSARY FOR THE DISPOSAL OF DEAD BODIES.

The analysis shows that no disposition, burial, cremation, disinterment, or removal can be made without a permit in the following States and Territories:

Arizona.	Michigan.	North Dakota.
California.	Minnesota.	Ohio.
Colorado.	Missouri.	Pennsylvania.
Connecticut.	Montana.	Rhode Island.
Delaware.	Nebraska.	South Dokota.
District of Columbia.	New Hampshire.	Utah.
Indiana.	New Jersey.	Vermont.
Kentucky.	New York.	Washington.
Maine.	North Carolina (in cities over 1,000).	Wisconsin.
Maryland.		
Massachusetts.		

The same requirement is enforced by rules of the state board of health in Florida, and a similar provision is contained in the sanitary codes of Louisiana and Texas.

In Iowa a death certificate is required by law for the disposition of a corpse, a permit in case of disinterment, and for its transportation a permit in addition to the certificate. In accordance with rules of the state board of health a permit is required in Kansas for disinterment.

In Nevada a physician's certificate or coroner's permit is required for burial, and a permit for disinterment. In Oregon a death certificate is required for burial or cremation, and in Oklahoma a physician's certificate is required by law for transportation, and by regulation of the state board of health for burial. In Wyoming death must be registered before interment, cremation, or transportation.

A death certificate is required in Porto Rico prior to burial or transportation.

Penalties are provided for the violation of laws or rules relating to dead bodies in the following States:

Arizona.	Massachusetts.	Oklahoma.
California.	Michigan.	Oregon.
Colorado.	Minnesota.	Pennsylvania.
Connecticut.	Missouri.	Rhode Island.
Delaware.	Montana.	South Dakota.
District of Columbia.	Nebraska.	Texas.
Indiana.	Nevada.	Utah.
Iowa.	New Jersey.	Vermont.
Kansas.	North Carolina.	Washington.
Louisiana.	North Dakota.	Wisconsin.
Maine.	Ohio.	Wyoming.
Maryland.		

In some of these States the general penalties for violation of the rules of the state boards of health apply, and other States may have similar provisions.

REGULATION OF BURIALS.

Powers are conferred by law on local authorities to regulate burials in the following States:

Arizona.
Arkansas.
California.
Colorado (cemeteries only).
Georgia.
Hawaii.
Indiana.
Iowa.
Kansas.
Kentucky (cemeteries only).
Massachusetts.
Michigan.
Minnesota (in villages).
Missouri.
Montana.
New Hampshire (also disinterment and removal).
New Jersey (also disinterment).
New York (also removal).
North Dakota.
Porto Rico.
Rhode Island.
Texas.
Utah.
Vermont (cemeteries only).
Washington.
West Virginia.

In other States where no statutes authorize specifically such regulation the general statutory powers granted to local authorities might be sufficient to enable them to enforce such regulations.

SPECIAL RESTRICTIONS REGARDING ISSUANCE OF PERMITS FOR BODIES DEAD OF CONTAGIOUS DISEASES.

In cases of death from contagious diseases permits can not be issued in some States for disposition of the body until conditions specified by the state board of health have been complied with. In the other States and Territories, so far as ascertained, these cases are covered by general provisions of law or regulation. The States having special laws restricting the issuance of permits are as follows:

California.
Connecticut.
Maryland.
Michigan.
Vermont (only in smallpox, cholera, typhus fever, scarlet fever, diphtheria and plague).
Wisconsin.

REGULATIONS REGARDING TIME OF BURIAL OR DISPOSITION OF BODIES.

The time within which bodies must be buried or otherwise disposed of is limited in certain of the States and Territories. In Nebraska bodies dead of smallpox must be disposed of immediately, and in Kentucky in 12 hours.

In Florida 12 hours is the limit with bodies dead of diphtheria, scarlet fever, smallpox, cholera, plague, typhus fever, and yellow fever, and 24 hours in other diseases unless the body is embalmed; if embalmed, 5 days. In Georgia, Idaho, and Ohio in cases of contagious diseases the time limit is 24 hours, and in Indiana it is 24 hours for cases of cholera, plague, leprosy, typhus fever, yellow fever, smallpox, diphtheria, scarlet fever, and cerebro-spinal meningitis. In Wisconsin it is 24 hours for cases of cholera, yellow fever, smallpox, typhus fever, plague, diphtheria, and scarlet fever. In Delaware bodies dead of smallpox, plague, cerebro-spinal meningitis, cholera, yellow fever, typhus fever, diphtheria, scarlet fever, erysipelas, glanders, anthrax, or leprosy must be buried within 30 hours. In Pennsylvania the limit of disposal is 36 hours for bodies dead of cholera, glanders, plague, smallpox, yellow fever, typhus fever, scarlet fever, relapsing fever, cerebro-spinal meningitis, diphtheria, tetanus, and leprosy. In Iowa cases of cholera, yellow fever, leprosy, plague, cerebro-spinal meningitis, diphtheria, and scarlet fever must be cremated or buried immediately after embalming or disinfection.

In Arizona 72 hours is the fixed time. In Minnesota, Montana, and North Dakota 4 days is established for ordinary cases, and 24 hours in the case of bodies dead of

contagious and infectious diseases. In the District of Columbia 7 days is the stated time, but in cases of diphtheria, scarlet fever, cerebro-spinal meningitis, and measles it is 48 hours, and if the body is to be cremated it shall not be done until at least 4 hours after death. In Connecticut, Massachusetts, New York, Oklahoma, and South Dakota the laws stipulate a reasonable time, but in Connecticut and Massachusetts it is required that bodies to be cremated must be held at least 48 hours, and regulations in force in Connecticut fix a time limit of 4 days in ordinary cases and 36 hours in cases of cholera, yellow fever, typhus fever, smallpox, typhoid fever, diphtheria, or scarlet fever. In Alabama, if the interment is delayed too long and the corpse becomes a source of danger to the public health, it is the duty of the sheriff to take charge of the burial of the same.

In Porto Rico, in cases of cholera, yellow fever, smallpox, diphtheria, scarlet fever, typhus fever, cerebro-spinal meningitis, leprosy, glanders, and plague, funeral must take place within 12 hours after death.

REQUIREMENTS REGARDING DEPTH OF GRAVES.

In Connecticut, New Jersey, Porto Rico, and the District of Columbia 4 feet from the surface of the ground is prescribed as the minimum depth of graves. In Pennsylvania it is 5 feet and in Louisiana 6 feet. In Iowa and Nebraska cases of smallpox are required to be buried deep.

RESTRICTIONS AS TO PUBLIC FUNERALS.

No public funeral can be held in the following States and Territories over bodies dead of—

Scarlet fever.

Connecticut.
District of Columbia.
Georgia.
Idaho.
Indiana.
Iowa.
Kansas.
Minnesota.
Montana.
Nebraska.
Ohio.
Oklahoma.
Pennsylvania.
Porto Rico.
Wisconsin.
Wyoming.

Smallpox.

Connecticut.
Georgia.
Idaho.
Indiana.
Iowa.
Kansas.
Montana.
Minnesota.
Ohio.
Oklahoma.
Pennsylvania.
Porto Rico.
Wisconsin.
Wyoming.

Cholera.

Connecticut.
District of Columbia.
Georgia.
Idaho.
Indiana.
Iowa.
Kansas.
Nebraska.
Ohio.
Oklahoma.
Pennsylvania.
Porto Rico.
Wisconsin.

Diphtheria.

Connecticut.
Georgia.
Idaho.
Indiana.
Iowa.
Kansas.
Minnesota.
Montana.
Nebraska.
Ohio.
Oklahoma.
Pennsylvania.
Porto Rico.
Wisconsin.
Wyoming.

Yellow fever.

Connecticut.
Georgia.
Idaho.
Indiana.
Iowa.
Nebraska.
Ohio.
Pennsylvania.
Porto Rico.
Wisconsin.

Cerebro-spinal meningitis.

District of Columbia.
Indiana.
Iowa.
Kansas.
Oklahoma.
Pennsylvania.
Porto Rico.
Wyoming.

Typhus fever.

Connecticut.	Indiana.	Porto Rico.
Georgia.	Ohio.	Wisconsin.
Idaho.	Pennsylvania.	

Plague.

Idaho.	Ohio.	Porto Rico.
Indiana.	Oklahoma.	
Iowa.	Pennsylvania.	

Leprosy.

Indiana.	Pennsylvania.	Porto Rico.
Iowa.	Nebraska.	

Measles.

District of Columbia.	Oklahoma.	Wyoming.
Iowa.		

In addition to the above, public funerals are not allowed in Nebraska over bodies dead of puerperal fever; in Pennsylvania over bodies dead of glanders, relapsing fever, and tetanus, and in Wyoming over bodies dead of chicken pox, mumps, and whooping cough. In Wyoming also the state board of health is required to issue special instructions in cases of cholera, plague, yellow fever, and typhus fever.

In Idaho, Kansas, Minnesota, Montana, North Dakota, and Ohio public funerals are interdicted in cases of any dangerous communicable disease. In Maryland, in cases of contagious or infectious diseases, the funerals must be conducted according to rules of the state board of health.

DISINFECTION OF BODIES REQUIRED.

Disinfection of bodies dead of any of the contagious diseases is required in North Dakota, Connecticut, Minnesota, and Montana; in the last two States bodies are to be taken care of by an embalmer. In Kentucky disinfection is required of bodies dead of smallpox, scarlet fever, and diphtheria; in Wisconsin and Idaho of bodies dead of smallpox, scarlet fever, diphtheria, cholera, plague, yellow fever, and typhus fever; in Iowa and Porto Rico of same diseases as Idaho and Wisconsin, and in addition leprosy and cerebro-spinal meningitis, the body to be embalmed if possible; in Pennsylvania of same diseases as Wisconsin and Idaho, and in addition glanders, relapsing fever, cerebro-spinal meningitis, tetanus, and leprosy; in Nebraska of bodies dead of smallpox, scarlet fever, diphtheria, yellow fever, cholera, leprosy, and puerperal fever.

In Colorado local health officers must supervise funerals of bodies dead of communicable diseases. If interment is delayed too long local authorities must take measures for burial in Alabama and Maryland, but in the latter State only in case of infectious and contagious diseases. In California the state board of health may assume control of bodies dead of infectious or contagious diseases.

In Oklahoma in cases of cholera, plague, cerebro-spinal meningitis, diphtheria measles, scarlet fever, and smallpox the body must be prepared by a licensed embalmer.

Finally, in those States which have adopted the rules recommended by the conference of state and provincial boards of health, the rules relating to disinfection of bodies to be transported are presumably enforced. A copy of the rules as amended in 1905 appears on page 73.

DISINTERMENTS.

In Delaware disinterments are forbidden of bodies dead of smallpox, plague, cholera, yellow fever, typhus fever, glanders, anthrax, and leprosy. In cases of diphtheria, scarlet fever, cerebro-spinal meningitis, and erysipelas, disinterment is allowed only after a body has been buried three years.

In the District of Columbia disinterments of bodies are not allowed where death has been due to cholera, yellow fever, typhus fever, smallpox, leprosy, plague, tetanus, or scarlet fever; and in other diseases, only after ten years.

In Indiana disinterments are not allowed of bodies dead of cholera, plague, leprosy, typhus fever, yellow fever, smallpox, diphtheria, cerebro-spinal meningitis, or scarlet fever, except with permission of the state board of health.

In Nebraska bodies dead of smallpox, cholera, yellow fever, typhus fever, or plague can not be disinterred except by special permission of the state board of embalmers, and other bodies by permission of the secretary of the above board.

In Kansas permits for disinterments of bodies dead of yellow fever, smallpox, diphthoria, or scarlet fever, are required to be granted only by the state board of health while in session; in other cases, permits may be obtained from the secretary.

In Iowa no disinterments are allowed in cases of smallpox, cholera, yellow fever, or plague; all otber disinterments to be made by licensed undertakers only on permission of the state board of health.

In Louisiana bodies dead of acute infectious diseases are not allowed to be disinterred within five years after death, and in Nevada disinterment of such cases is not allowed at all.

In Porto Rico no body can be disinterrod within 5 years after death, and disinterment must be made during daylight between January 1 and April 1, permission having previously been obtained from the superior board of health.

In Michigan, except in the Upper Peninsula, no removal of dead bodies is allowed during June, July, August, or September.

In Montana permits for disinterments are granted only to licensed embalmers.

In Maryland no disinterments are allowed in July and August, nor in cases of contagious and infectious diseases except by permission of the local board of health.

In New Jersey disinterments are not allowed from May 1 to November 1, and never in cases of cholera, smallpox, and yellow fever, unless the body was originally inclosed in a metallic case, and never in case of typhus or spotted fever, scarlet fever, or relapsing fever, unless buried for three years, tbe body having originally been placed in a metallic case, or disinterred between October and April.

In Ohio no disinterments are allowed in April, May, June, July, August, and September, and never in the case of infectious or contagious diseases until a permit has bas been issued by the local health department.

In Oklahoma disinterments of bodies dead of smallpox, cholera, yellow fever, plague, or leprosy are forbidden; other bodies can be disinterred by a licensed embalmer only on written permission of the state commissioner of health and local health officer.

In Ponnsylvania no disinterments are allowed in June, July, August, and September, nor between sunset and sunrise; bodies dead of smallpox, anthrax, cholera, relapsing fever, yellow fever, cerebro-spinal meningitis, scarlet fever, and diphtheria not being allowed to be disinterred for ten years except by permission of the state department of healtb.

STATE HEALTH AUTHORITIES HAVING POWER TO REGULATE TRANSPORTATION OF DEAD BODIES.

Alabama.
Arizona (powers implied).
Arkansas (to regulate issue and use of transfer permits by local boards of health only).
California (also embalming, cremation, burial, and disinterment).
Colorado (powers implied).
Connecticut (powers implied).
Delaware.
District of Columbia (powers implied)
Florida (powers implied).
Georgia (powers implied).
Idaho.
Illinois.
Indiana.
Iowa (powers implied).
Kansas.
Kentucky (powers implied).
Louisiana.
Maine (also speedy interment in cases of contagious diseases).
Maryland (powers implied).

Minnesota (also burials and locations of mortuaries
Massachusetts (powers implied).
Michigan (powers implied).
Mississippi (powers implied).
Montana.
Missouri (powers implied).
Nebraska (powers implied).
Nevada (powers implied).
New Hampshire (powers implied).
New Jersey (also disinfection and embalming).
New Mexico (powers implied).
New York (to regulate issue of transfer permits by local authorities).
North Carolina (powers implied).
North Dakota.
Ohio.
Oklahoma (powers implied).
Oregon (powers implied).
Pennsylvania (powers implied).
Rhode Island (powers implied).
South Carolina.
South Dakota (powers implied).
Tennessee (powers implied).
Texas.
Utah (powers implied).
Vermont.
Virginia (powers implied).
Washington.
West Virginia (powers implied).
Wisconsin (also speedy interment in case of contagious diseases).
Wyoming (powers implied).

Power is specifically reserved to local boards of health to regulate transportation within their jurisdictions in Alabama and Virginia, and apparently also in Arkansas and New York.

TRANSPORTATION OF DEAD BODIES.

There are only four States—California, Missouri, New Mexico, and Virginia—in which the provisions regulating the transportation of dead bodies have been actually enacted into law. In other States, including the District of Columbia, although the statutes may have some bearing, the subject is covered by rules issued in most cases by the state board of health, in a few by the state board of embalming, and in two cases (Arkansas and West Virginia) by both boards acting in cooperation.

It is well known that in the Conference of State and Provincial Boards of Health held in 1897 a number of shipping rules and regulations were recommended for adoption by the several States. These rules were subsequently amended by the conference at its meeting in 1903 with a view to make them more liberal. The amendments were accepted by most of the States, but a number have, however, not taken any action in regard to them. The amended rules are as follows:

Transportation rules approved and adopted by the American Association of General Baggage Agents, the Conference of State and Provincial Boards of Health, and the Nationla Funeral Directors' Association.

Rule 1. The transportation of bodies dead of smallpox and bubonic plague, from one State, Territory, district or province to another, is absolutely prohibited.

Rule 2. The transportation of bodies dead of Asiatic cholera, yellow fever, typhus fever, diphtheria (membranous croup), scarlet fever (scarlatina, scarlet rash), erysipelas, glanders, anthrax, or leprosy shall not be accepted for transportation unless prepared for shipment by being thoroughly disinfected by (*a*) arterial and cavity injection with an approved disinfecting fluid; (*b*) disinfection and stopping of all orifices with absorbent cotton, and, (*c*) washing the body with the disinfectant, all of which must be done by an embalmer holding a certificate as such, issued by the state or provincial board of health, or other state or provincial authority provided for by law.

After being disinfected as above, such bodies shall be enveloped in a layer of dry cotton not less than one inch thick, completely wrapped in a sheet securely fastened and encased in an air-tight zinc, copper, or lead lined coffin, or iron casket, all joints and seams hermetically sealed, and all enclosed in a strong, tight wooden box, or the body being prepared for shipment by disinfecting and wrapping as above, may be placed in a strong coffin or casket, encased in an air tight zinc, copper, or tin lined box, all joints and seams hermetically soldered.

For interstate transportation under this rule, only embalmers holding a license issued or approved by the state or provincial boards of health, or other state or provin-

cial authority provided by law, after examination, shall be recognized as competent to prepare such bodies for shipment.

RULE 3. The bodies of those dead of typhoid fever, puerperal fever, tuberculosis or measles may be received for transportation when prepared for shipment by arterial and cavity injection with an approved disinfecting fluid, washing the exterior of the body with the same, and enveloping the entire body with a layer of cotton not less than one inch thick and all wrapped in a sheet securely fastened and encased in an air-tight metallic coffin or casket, or air-tight metal-lined box, provided that this shall apply only to bodies which can reach their destination within 30 hours from time of death. In all other cases, such bodies shall be prepared by a licensed embalmer holding a certificate as provided for in Rule 2, when air-tight sealing and bandaging with cotton may be dispensed with.

RULE 4. The bodies of those dead from any cause not stated in Rules 2 and 3 may be received for transportation when encased in a sound coffin or casket, and enclosed in a strong outside wooden box, provided they can reach their destination within 30 hours from time of death. If the body can not reach its destination within 30 hours from the time of death, it must be prepared for shipment by arterial and cavity injection with an approved disinfecting fluid, washing the exterior of the body with the same and enveloping the entire body with a layer of dry cotton not less than one inch thick, and all wrapped in a sheet securely fastened and encased in an air-tight metallic coffin or casket or an air-tight metal-lined box. But when the body has been prepared for shipment by being thoroughly disinfected by a licensed embalmer, as defined and directed in Rule 2, the air-tight sealing and bandaging with cotton may be dispensed with.

RULE 5. In the shipment of bodies dead from any disease named in Rule 2, such body must not be accompanied by persons or articles which have been exposed to the infection of the disease, unless certified by the health officer as having been properly disinfected.

Before selling ticket, agents should carefully examine the transit permit and note the name of the passenger in charge, and of any others proposing to accompany the body, and see that all necessary precautions have been taken to prevent the spread of the disease. The transit permit shall in such cases specifically state who is authorized by the health authorities to accompany the remains. In all cases where bodies are forwarded under Rule 2, notice must be sent by telegraph by the shipping embalmer to the health officer, or, when there is no health officer, to other competent authority, at destination, advising the date and train on which the body may be expected.

RULE 6. Every dead body must be accompanied by a person in charge, who must be provided with a passage ticket and also present a full first-class ticket marked "corpse" for the transportation of the body, and a transit permit showing physician's or coroner's certificate, name of deceased, date and hour of death, age, place of death, cause of death, and all other items of the standard certificate of death recommended by the American Public Health Association and adopted by the United States Census Bureau, as far as obtainable, including health officer's or registrar's permit for removal, whether a communicable or noncommunicable disease, the point to which the body is to be shipped, and when death is caused by any of the diseases specified in Rule 2, the names of those authorized by the health authorities to accompany the body. Also the undertaker's certificate as to how the body has been prepared for shipment. The transit permit must be made in duplicate, and the signatures of the physician or coroner, health officer, and undertaker must be on both the original and duplicate copies. The undertaker's certificate and paster of the original shall be detached from the transit permit, and securely fastened on the end of the coffin box. All coffin boxes must be provided with at least four handles. The physician's certificate and transit permit shall be handed to the passenger in charge of the corpse. The whole duplicate

copy shall be seut to the official in charge of the baggage department of the initial line, and by him to the secretary of the state or provincial board of health of the State or Province from which said shipment is made.

RULE 7. When bodies are shipped by express a transit permit as described in Rule 6 must be made out in duplicate. The undertaker's certificate and paster of the original shall be detached from the transit permit and securely fastened on the coffin box. The physician's certificate and transit permit shall be attached to and accompany the express waybill covering the remains, and be delivered with the body at the point of destination to the person to whom it is consigned. The whole duplicate copy shall be sent by the forwarding express agent to the secretary of the state or provincial board of health of the State or Province from which said shipment was made.

RULE 8. Every disinterred body, dead from any disease or cause, shall be treated as infectious or dangerous to the public health and shall not be accepted for transportation unless said removal has been approved by the state or provincial health authorities having jurisdiction where such body is disinterred, and the consent of the health authorities of the locality to which the corpse is consigned has first been obtained; and all such disinterred remains, or the coffin or casket containing the same, must be wrapped in a woolen blanket thoroughly saturated with a 1-100 solution of corrosive sublimate, and enclosed in a hermetically soldered zinc, tin, or copper-lined box. But bodies deposited in receiving vaults shall not be treated and considered the same as buried bodies when originally prepared by a licensed embalmer as defined in Rule 2, and as directed in Rulo 2 or 3 (according to the nature of the disease causing death), provided shipment takes place within 30 days from time of death. The shipment of bodies prepared in the manner above directed by licensed embalmers from receiving vaults may be made within 30 days from the time of death without having to obtain permission from the health authorities of the locality to which the body is consigned. After 30 days the casket or coffin box containing said body must be enclosed in a hermetically soldered box.

In regard to the provisions for the transportation of dead bodies, most of the States may, therefore, be broadly classified into two great groups: Those that have adopted these transportation rules as amended in 1903, and those that still adhero to the original rules adopted in 1897. A few States remain outside of either group and have special rules of their own. To these separate consideration will be given.

The transportation rules as amended in 1903 bave been adopted in the following States:

California (yellow fever, cholera, typhus fever, glanders, anthrax added to Rule 1, smallpox eliminated—transportation may be allowed in all these cases inside the State by permission of the state board of health.)
Colorado.
Florida.
Idaho (pneumonia, chicken pox, and whooping cough added to Rule 3).
Illinois.
Iowa.
Kentucky.
Louisiana.
Maine.
Maryland.
Minnesota.
Nevada.
New Hampshire.
New York (transportation may be allowed in cases of smallpox and plague by approval of the commissioner of health, if body is prepared as provided in Rule 2).
North Dakota.
Ohio.
Oklahoma.
South Dakota.
Tennessee.
Vermont.
Virginia (transportation may be allowed in cases of smallpox and plague by state and local boards of health interested).
Washington.
West Virginia.
Wisconsin.
Wyoming.

The States which have adopted the rules of 1897 with slight amendments (copy of which is contained in the Annual Report of the American Public Health Association vol. 23, p. 452), are as follows:

Arizona.
Arkansas (cerebro-spinal meningitis added to Rule 2).
Georgia.
Indiana.
Massachusetts.
Mississippi.
Missouri (transportation of dead bodies mentioned in Rule 1 may be allowed when the body has been prepared under the supervision of an officer of the state board of health, or a member of the state board of embalmers—time specified in Rule 4 limited to 24 hours).
Montana (leprosy added to Rule 1).
Nebraska.
New Mexico (time specified in Rule 3 limited to 24 hours, in Rule 4 to 30 hours).
North Carolina.
Oregon (leprosy added to Rule 1).
Rhode Island.
South Carolina.
Texas (yellow fever excluded from Rule 1).
Utah.

In Massachusetts and Texas bodies of persons dead of diseases mentioned in Rule 1 may be transported if cremated.

The States having special rules of their own are:

Alabama.
Connecticut.
Delaware.
Kansas.
New Jersey.
Pennsylvania.
District of Columbia.

In Alabama bodies of persons dead of authrax, plague, glanders, typhus fever, or cholera can only be transported by special permission of the state health officer and with the consent of the local health authorities both at the places of death and destination. In cases of diphtheria, scarlet fever, yellow fever, or smallpox, the body in order to be transported must bo prepared in accordance with special requirements and by a liconsed embalmer. Such special precautions including embalming may be taken by a licensed physician when no licensed embalmer is available. In cases of smallpox transportation is only allowed during the months of June, July, August, and September, and in cases of yellow fever only during December, January, and February.

In cases of erysipelas, puerperal fever, pnoumonia, measles, cerebro-spinal meningitis, tuberculosis, typhoid fever, whooping cough, beriberi, mumps, or hydrophobia, the body, in order to be entitled to transportation, must bo prepared in accordance with detailed specifications similar to those contained in No. 2 of the transportation rules.[a]

In othor diseases corpses shall bo ontitlod to transportation without further preparation than such as is usually employed for interment. If offered for shipment botween April 1 and November 1, tho destination must bo reached in 24 hours; at any other season in 36 hours.

In Connecticut transportation is not allowed by law in cases of cholera, yellow fever, diphtheria, typhus fevor, scarlet fever, typhoid fever, measles, leprosy, and smallpox unless the body is inclosed in an air-tight coffiu, hermetically sealed, or disinfected according to the rules of tho state board of health and all bodies must be accompanied by a printed permit attach.d to the casket.

In Dolaware transportation is prohibited in cases of smallpox, plague, cerebrospinal meningitis, cholera, yellow fever, typhus fever, diphtheria, scarlet fever, erysipelas, glandors, anthrax, or leprosy. Bodies dead of puerperal fever may be transported aftor preparation in accordance with provisions similar to those contained

[a] The words "transportation rules" whenever used in this analysis stand for transportation rules recommended by the Conference of State and Provincial Boards of Health.

in Rule 2 of the transportation rules. Bodies dead of other diseases are required to be prepared in accordance with provisions similar to those contained in Rule 3 of the said transportation rules.

In Kansas no dead body can be transported unless it has been embalmed for at least 12 hours.

Bodies of persons dead of measles, erysipelas, diphtheria, scarlet fever, glanders, anthrax, smallpox, cholera, yellow fever, typhus fever, plague, or leprosy may be transported if prepared in accordance with requirements similar to those contained in Rule 2.

Other bodies may be transported if prepared as provided in Rule 4 for bodies that cannot reach their destination in 30 hours.

Bodies of persons dead from any infectious disease must be prepared by a licensed embalmer.

In Michigan bodies dead of diphtheria, scarlet fever, glanders, anthrax, smallpox, cholera, yellow fever, typhus fever, plague, and leprosy can be transported in accordance with requirements similar to those of Rule 2 of the transportation rules. Bodies dead of typhoid fever, puerperal fever, erysipelas, tuberculosis, measles, rötbeln, whooping-cough, pneumonia, infectious meningitis, rabies, and tetanus may be transported in accordance with requirements similar to those of Rule 3. Bodies dead of other diseases may be transported in accordance with requirements similar to Rule 4, but no time limit is fixed to reach destination.

In New Jersey bodies of persons dead of smallpox, cholera, yellow fever, typhus fever, or plague can only be transported by permission of the state board of health in accordance with specified written requirements. Bodies of persons dead of diphtheria, scarlet fever, chicken pox, measles, and erysipelas must be prepared in accordance with requirements similar to those of No. 2 of the transportation rules. Other bodies are divided into two classes: Bodies that are not to remain unburied longer than 72 hours and bodies to remain unburied longer than 72 hours. The requirements for bodies that are to remain unburied longer than 72 hours are identical with those demanded in cases of diphtheria and scarlet fever. In other cases the airtight, metal-lined box is not required.

In Pennsylvania in cases of cholera, anthrax, leprosy, relapsing fever, smallpox, yellow fever, and plague the body can be transported only within the limits of the district in which death occurred or into some district immediately adjacent.

In cases of diphtheria, scarlet fever, cerebro-spinal meningitis, transportation beyond the adjacent district can only take place if requirements similar to those specified in No. 2 of the transportation rules are complied with.

In cases of noncontagious diseases the body can be transported only when thoroughly disinfected and embalmed, or, if the destination can be reached in 24 hours, when placed in a casket or coffin inclosed in an outside wooden box. Otherwise the coffin, casket, or outside case must be metal or metal-lined and hermetically sealed. In all cases the undertaker's affidavit is necessary for receiving a permit from the local registrar.

In the District of Columbia transportation is forbidden in cases of diphtheria, scarlet fever, measles, cerebro-spinal meningitis, and typhoid fever unless the body is embalmed and prepared in accordance with provisions similar to those contained in No. 2 of transportation rules. Apparently bodies dead of cholera, yellow fever, typhus fever, smallpox, leprosy, or plague are not allowed transportation into or through the District.

In addition to these specific rules the following States have some provisions in their statutes dealing rather broadly with the subject: Arizona, Massachusetts, New Jersey, New York, North Carolina, North Dakota, South Carolina, and Wisconsin.

The Massachusetts law forbids transportation in cases of smallpox, scarlet fever, diphtheria, and typhus fever unless the body is properly prepared and encased so as to preclude the danger of contagion.

An act of New Jersey forbids transportation in cases of smallpox, yellow fever, cholera, typhus fever, and plague unless the body is inclosed in a hermetically-sealed casket and permission is obtained from the state board of health. Other bodies may be transported if rules of the state board of health are complied with.

The New York statute provides that in cases of contagious or infectious diseases the body must be inclosed in a hermetically sealed casket of metal or other indestructible material before permit for transportation is given by a local board of health.

In North Carolina no permit can be granted for transportation in cases of smallpox, measles, scarlet fever, diphtheria, typhus fever, yellow fever, and cholera until the directions of the state board of health relating to disinfection and encasing are complied with.

In North Dakota and Arizona the transportation of any body dead of a contagious, infectious, or epidemic disease is forbidden without permission from the state or local board of health. There seems to be a conflict in the laws of North Dakota bearing on this matter. Section 281, codes of 1905, forbids common carriers to accept dead bodies for transportation unless accompanied by a certificate stating that the death was not caused by a contagious disease, and on the other hand section 255 empowers the state board of health to determine what classes of dead bodies may be transported, and the language used in sections 340 to 348 (embalmers' act) practically implies that in cases of contagious diseases tho body may be transported.

In Porto Rico transportation is forbidden of bodies dead of smallpox, cholera, typhus fever, diphtheria, yellow fever, or any other quarantinable disease except by permission of the superior board of health. In all these cases the body must be inclosed in a hermetically sealed metal-lined coffin and previously inspected by an agent of tho superior board of health.

The South Carolina law forbids transportation in cases of infectious, contagious, or dangerous diseases, except in accordance with the rules of the state board of health.

In South Dakota transportation of dead bodies is forbidden unless prepared by a licensed embalmer.

In Wisconsin a statute forbids the transportation of certain dead bodies unless some requirements set forth in full are complied with.

It will be seen from the above that the States in which, under certain restrictions, all bodies may be transported are Alabama, Connecticut, Kansas, Massachusetts, Michigan, Missouri, New York, Texas, and Virginia. On the other hand, the State having most severe restrictions over transportation of dead bodies is Delaware.

In the following States preparation by a licensed embalmer is required of bodies dead of any disease mentioned in transportation rule 2:

Colorado.	Maryland.	Rhode Island.
Florida.	Massachusetts.	South Carolina.
Georgia.	Nebraska.	Tennessee.
Idaho.	Nevada.	Texas.
Illinois.	New Mexico.	Utah.
Indiana.	North Carolina.	Vermont.
Iowa.	North Dakota.	Virginia.
Kentucky.	Ohio.	West Virginia.
Maine.	Oklahoma.	Wisconsin.

Preparation by a licensed embalmer of all bodies, regardless of the cause of death, is required in Kansas, Minnesota, Montana, New York, and South Dakota; in any contagious or infectious disease in Arkansas and Washington; in cases of yellow fever, smallpox, scarlet fever, and diphtheria in Alabama; and in cases of puerperal fever in Delaware.

TRANSPORTATION OF DISINTERRED BODIES.

The transportation of disinterred bodies is made in the following States in accordance with rules identical with or similar to those adopted by the Conference of State and Provincial Boards of Health:

Arizona.	Maryland.	Ohio.
Arkansas.	Massachusetts.	Oklahoma.
California.	Michigan.	Oregon.
Colorado.	Minnesota.	Pennsylvania.
Delaware.	Mississippi.	Rhode Island.
Florida.	Missouri.	South Carolina.
Georgia.	Montana.	South Dakota.
Idaho.	Nebraska.	Tennessee.
Illinois.	Nevada.	Texas.
Indiana.	New Hampshire.	Utah.
Iowa.	New Jersey.	Vermont.
Kansas.	New Mexico.	Virginia.
Kentucky.	New York.	Washington.
Louisiana.	North Carolina.	West Virginia.
Maine.	North Dakota.	Wisconsin.

TRANSPORTATION OF BODIES DEPOSITED IN VAULTS.

The transportation of bodies that have been deposited in vaults is made according to rules adopted by the Conference of State and Provincial Boards of Health in the following States:

Colorado.	Maryland.	Oklahoma.
Florida.	Minnesota.	South Dakota.
Idaho.	Montana.	Tennessee.
Illinois.	Nevada.	Vermont.
Iowa.	New Hampshire.	Virginia.
Kentucky.	New York.	Washington.
Louisiana.	North Dakota.	West Virginia.
Maine.	Ohio.	Wisconsin.

Bodies deposited in vaults are considered as buried bodies in the following States:

Arizona.	Michigan.	North Carolina.
Arkansas.	Mississippi.	Oregon.
California.	Montana.	Rhode Island.
Georgia.	Nebraska.	South Carolina.
Indiana.	New Jersey.	Texas.
Massachusetts.	New Mexico.	Utah.

THE LICENSING OF EMBALMERS.

Special boards are in charge of the examination and licensing of embalmers in the following States:

Alabama.
Arizona.
Arkansas.
Connecticut.
Georgia.
Indiana.
Kansas.
Kentucky.
Maine (half of the board is composed of members of the state board of health).
Maryland.
Missouri.
Nebraska (board appointed by state board of health).
Nevada.
New Jersey.
New Mexico.
New York.
North Carolina.
North Dakota.
Ohio.
Oklahoma.
Pennsylvania.
Rhode Island.
South Dakota (two of the five members are the president and secretary of the state board of health).
Tennessee (one member must belong to state board of health).
Texas.
Virginia.
Washington (one member is secretary of the state board of health).
West Virginia.

The examinations are conducted by a special board appointed in Idaho and Iowa by the state board of health, but licenses are issued by the state board of health in Idaho, Massachusetts (licenses issued by local boards of health), and Iowa.

The examinations and licensing are administered by the state board of health in the following States:

Colorado (under general powers and by mutual arrangements with undertakers).
Florida (under general powers).
Illinois.
Louisiana (under general powers, examination optional).
Michigan.
Minnesota.
Montana (under general powers).
New Hampshire.
Oregon (under general powers).
South Carolina.
Utah (under general powers).
Vermont.
Wisconsin.
Wyoming (under general powers).

The jurisdictions without provisions for licensing are as follows:

California.
Delaware.
District of Columbia.
Mississippi.

SUPERVISION OVER EMBALMING FLUIDS.

The embalming fluids used must be approved by the state board of health in California, and the quantity and quality are determined by regulation in Minnesota. The use of arsenic or strychnine in embalming fluids is forbidden in Illinois; the use of arsenic and mercury in Minnesota and Iowa, the use of arsenic in Michigan, Montana, and New Jersey, and the use of arsenic or any other deadly poison in Mississippi is forbidden.

Rule 4 of the transportation rules adopted by the Conference of State and Provincial Boards of Health requires the use of an "approved" disinfecting fluid. The abovementioned rules in their original form in 1897 or as amended in 1903 have been adopted in 39 States, as previously stated.

Doctor KERR. The rules adopted by the Conferences of State and Provincial Health Officers, in 1897 and amended in 1903, now apply in their original or amended form in 39 States. A list of those has been given, but one point in these rules has not been settled—as to what a perfect disinfectant shall be, and Doctor Anderson has considered that subject.

Doctor ANDERSON. Some of the points in my paper were taken up by me the other day in the discussion of the report of the committee on transportation of the dead, but the point I wish particularly to talk to you about is that portion of the regulations for the transportation of the dead which requires arterial and cavity injection with an approved disinfecting fluid.

WHAT SHOULD CONSTITUTE AN APPROVED DISINFECTANT FOR THE TRANSPORTATION OF THE DEAD?

By John F. Anderson, Director, Hygienic Laboratory, Washington, D. C.

At the 1903 Conference of State and Provincial Boards of Health a uniform certificate and rules for the transportation of dead bodies was adopted.

Rule 1 provided that the transportation of bodies dead of smallpox or bubonic plague from one State, Territory, or province to another is absolutely prohibited.

Rule 2 provides that the transportation of bodies dead of Asiatic cholera, yellow fever, typhus fever, diphtheria (membranous croup), scarlet fever (scarlatina, scarlet rash), erysipelas, glanders, anthrax, or leprosy shall not be accepted for transportation

unless prepared for shipment by being thoroughly disinfected by (*a*) arterial and cavity injection with an approved disinfecting fluid, (*b*) disinfection and stopping of all orifices with absorbent cotton, and (*c*) washing the body with a disinfectant. * * *

Rule 3 provides that the bodies of those dead of typhoid fever, puerperal fever, tuberculosis, or measles may be received for transportation when prepared by arterial and cavity injection with an approved disinfecting fluid, washing the exterior of the body with the same, and * * * .

Rule 4 provides that the bodies dead of any cause not stated in Rules 2 and 3, if in transit longer than 30 hours, shall be prepared as provided for in Rules 2 and 3.

The question as to what constitutes an approved disinfecting fluid, in accordance with the provisions of the foregoing rules, was not decided, that being left to the individual state health boards. This failure to decide what should constitute an approved disinfecting fluid largely deprives the above rules of their sanitary value, if dead bodies are considered as probable sources of infection.

In examining the certificates for the transportation of the dead sent in by the various state boards of health, it was noted that many of them absolutely prohibited the transportation of bodies dead of cholera, yellow fever, typhus fever, anthrax, glanders, leprosy, and relapsing fever. Most of them in addition prohibit from transportation bodies of persons dead of smallpox and bubonic plague.

It would seem reasonable to absolutely prohibit the transportation of bodies of persons dead of bubonic plague, cholera, and perhaps smallpox; but there can certainly be no danger in the transportation of a body dead of yellow fever and leprosy and perhaps typhus fever. The transportation of bodies dead from the other diseases, when prepared in accordance with a uniform certificate and a satisfactory fluid used for embalming, would be in my opinion a perfectly safe procedure.

Table showing the form of certificate, what bodies are prohibited transportation, approved fluids, and how controlled, according to the laws and regulations of the various States and Territories.

State.	Form of certificate.	Not allowed transportation.	Approved fluids.	How controlled.
Alabama				
Arizona	Uniform	Smallpox, bubonic plague, cholera, yellow fever, typhus fever.	None	
Arkansas	do	do	do	
California	do	Cholera, yellow fever, typhus fever, anthrax, glanders, bubonic plague.	Recommends formula No. 3.	
Colorado	do	Smallpox, bubonic plague	Any recognized standard embalming fluids or formalin solution, no arsenic.	Not stated.
Connecticut	None	None	None	
Delaware	Uniform; considerably modified.	Smallpox, bubonic plague, cerebro-spinal meningitis, cholera, yellow fever, typhus fever, diphtheria (membranous croup), scarlet fever (scarlet rash, scarlatina), erysipelas, anthrax, glanders, leprosy.	No arsenic or mercury allowed; formula No. 3 recommended.	Do.
District of Columbia	Special	Cholera, yellow fever, typhus fever, smallpox, plague, leprosy, glanders.	None	
Florida	Uniform	Smallpox, bubonic plague.	do	
Georgia		Smallpox, cholera, yellow fever, typhus fever, bubonic plague.		
Idaho	Uniform	Smallpox, bubonic plague.	None	Do.
Illinois	do	do	do	Do.
Indiana	do	Smallpox, cholera, yellow fever, typhus fever, bubonic plague.	Formula No. 3	Do.
Iowa	do	Smallpox, bubonic plague	Formula No. 3; no arsenic or mercury.	Do.

Table showing the form of certificate, what bodies are prohibited transportation, approved fluids, and how controlled, according to the laws and regulations of the various States and Territories—Continued.

State.	Form of certificate.	Not allowed transportation.	Approved fluids.	How controlled.
Kansas	Uniform	None	For certain diseases, must contain not less than 14 per cent formaldehyde; for other diseases, not less than 10 per cent formaldehyde.	Regulation of state board of health.
Kentucky	do	Smallpox, bubonic plague		
Louisiana	do	do	None	
Maine	do	do	do	
Maryland	do	do	do	
Massachusetts	do	Smallpox, cholera, yellow fever, typhus fever, bubonic plague, except after cremation.	do	
Michigan	Uniform; modified.	None	At least 8 per cent formaldehyde.	Do.
Minnesota	Uniform	Smallpox, bubonic plague	Must contain 5 per cent at least by weight formaldehyde gas; no chloral, arsenic, mercury, zinc, or other mineral poison.	Formula of every embalming fluid sold in State required to be filed in office of the secretary of state.
Mississippi	do	Smallpox, bubonic plague, cholera, yellow fever, typhus fever.	None; but considers 25 per cent solution formaldehyde an approved disinfecting fluid.	
Missouri	Uniform; considerably modified.	None; all allowed under certain restrictions.	None	
Montana	Uniform	Smallpox, bubonic plague, cholera, yellow fever, typhus fever.	None; a disinfectant approved by National Embalmers' Association is considered an approved disinfectant; must contain no arsenic or other mineral poison.	
Nebraska	do	do	None	
Nevada	None			
New Hampshire	Uniform	Smallpox, bubonic plague	None; recommends formula No. 3.	
New Jersey	Special	None; all allowed under certain restrictions.	None, bodies shall not be injected with arsenical or other poisonous fluids.	
New York	Uniform; modified.	None; under restrictions	Must not contain arsenic, zinc, mercury, copper, lead, silver, antimony, or chloral; or any substance or compound that contains any of them or any poisonous alkaloid.	By examination of germicidal qualities or chemical analysis under direction of state board of embalmers.
North Carolina	Special	do	None	
North Dakota	Uniform	Smallpox, bubonic plague	Formula No. 3	
Ohio	do	do	None	
Oklahoma	do	do		
Oregon	do	Smallpox, bubonic plague, cholera, yellow fever, typhus fever, leprosy.	"Approved fluids by state board are 1:1000 solution bichloride or formalin 40 per cent."	Not stated.
Pennsylvania	Special	Cholera, anthrax, leprosy, relapsing fever, smallpox, yellow fever, bubonic plague.	None	
Rhode Island	Uniform	Smallpox, cholera, yellow fever, typhus fever, bubonic plague, except after cremation.	do	

Table showing the form of certificate, what bodies are prohibited transportation, approved fluids, and how controlled, according to the laws and regulations of the various States and Territories—Continued.

State.	Form of certificate.	Not allowed transportation.	Approved fluids.	How controlled.
South Carolina	Uniform	Smallpox, cholera, yellow fever, typhus fever, bubonic plague.	None	Not stated.
South Dakota	do	Smallpox, bubonic plague	do	
Tennessee	do	do	Must contain 5 to 10 per cent formaldehyde.	
Texas	Uniform; slightly modified.	Cholera, bubonic plague, smallpox, unless cremated.	None	
Utah	Uniform	Smallpox, bubonic plague, yellow fever, typhus fever, cholera.	do	
Vermont	Uniform	Smallpox, bubonic plague	Recommends formula No. 3.	
Virginia				
Washington	do	do	None	
West Virginia				
Wisconsin	Uniform	Smallpox, bubonic plague	None	

In order to find out how many state health boards have decided what should constitute an approved disinfecting fluid within the above-mentioned rules, I addressed a letter to each state health officer asking for this information. Replies were received from all but the health officers of Alabama, Virginia, and West Virginia.

Of those from whom replies were received, only five have approved disinfecting fluids, the essential agent of all of which is formaldehyde. A number recommended formula No. 3.

I think there can hardly be any question but that the living body is the greatest source of infection; but at the same time we must take into consideration the probable danger of the dead body also as a source of infection, though in my opinion the relatives and friends who accompany the body oftentimes are a greater possible danger than the dead body.

The certificate and rules adopted by the Conference of the State and Provincial Boards of Health had for their object a most excellent purpose, i. e., uniformity in rules regulating the transportation of the dead. There should consequently be a uniformity in their enforcement and this, of course, can not be unless there is uniformity in what shall be considered approved disinfecting fluid for the preparation of the dead body.

Embalming fluids may be considered as having two distinct purposes: First, the preservation of the body in order that it may not be objectionable during transit and thus create a nuisance, and, second, a sanitary purpose or, in other words, a destruction of the infecting organisms. There is of course a wide difference in a fluid that is antiseptic and one that is germicidal. In my opinion all embalming fluids should be of the latter class.

The ideal method for the disposition of the dead is by cremation, but neither the public nor the physicians have been sufficiently educated for this to be universally adopted. And while we may feel that in matters of this kind public opinion should be ignored, still attention must be given to public opinion; and for that reason we must endeavor to provide means so that dead bodies may be transported without offense or danger to others.

In view of the preceding, the necessity for exact knowledge based upon research work to determine what might be considered as approved disinfecting fluids is at once apparent. By resolution the National Funeral Directors' Association requested the Surgeon-General of the United States Public Health and Marine-Hospital Service to

have an investigation of this subject made in the Hygienic Laboratory; the same request was also made by Dr. F. F. Wesbrook, of the Minnesota state board of health.

The only research work along these lines done in the United States of which I am aware was that done by the Minnesota state board of health under the direction of Doctor Wesbrook. As a result of those investigations the formula known as "Formula No. 3" was prepared and has been recommended for use. The principal agent in this formula is formaldehyde solution, so that the fluid contains about 5.18 per cent of pure formaldehyde gas.

As much work has been done in the Hygienic Laboratory upon the question of disinfectants, it seemed peculiarly fitting that the subject of embalming fluids, from their sanitary importance, should be taken up in the Hygienic Laboratory, and under instructions from the Surgeon-General the investigation was begun in the late winter of 1909–10 along the following lines:

1. A study of the germicidal properties of various solutions which have been used for embalming when injected into rabbits dead of anthrax.

2. A chemical examination of the various commercial or proprietary embalming fluids found on the market.

3. A study of the preservative or the power of these solutions to prevent putrefaction of dead bodies.

The animal experiments were largely done upon rabbits, which were infected with cultures of anthrax bacilli, and after death the bodies were prepared by arterial and cavity injection with the various solutions.

While this investigation is by no means completed, I think the results that we have obtained so far are sufficiently important to give a brief résumé of the most important ones.

Up to this time we have made 21 experiments with 17 different solutions on 21 rabbits dead from anthrax. The embalming fluid was injected into the carotid artery in the proportion of 8 parts of the fluid to 150 parts of body weight. An equal amount was also injected into the body cavities, half being injected intraperitoneally and the other half into the pleural cavity. In those which contain 5 per cent or more by weight of formaldehyde gas, the results are on the whole very satisfactory, though in only a few instances were the anthrax bacilli killed in the muscles and brain. In almost every instance cultures from the lungs, liver, spleen, and kidney were negative. The cultures obtained from the mouth, nose, large and small intestine, and the anus were the hay bacillus, which, as is known, is especially resistant in its spore form. In these situations it is not usual to find anthrax bacilli in animals dying from this infection.

In those animals embalmed with a 5 per cent solution of carbolic acid the results were not nearly so satisfactory, anthrax bacilli being recovered from a number of the organs.

Bichloride of mercury, in the strength of 1:1000, was totally ineffective. One per cent solution of bichloride of mercury in a 30 per cent sodium chloride solution was also very ineffective.

When formula No. 3, or the one which is the formula prepared under the direction of the Minnesota state board of health, was allowed to act for a longer period than 24 hours a decided increase in its germicidal properties was noted.

From the experiments that have been done so far, it would seem that an approved disinfecting fluid for use in the transportation of the dead should contain as its essential agent at least 5 per cent formaldehyde gas by weight and for medico-legal reasons should contain no arsenic, zinc, mercury, copper, lead, silver, antimony, chloral, or any compound of them, or any poisonous alkaloid; and that it should be used for arterial injections in the proportion of at least 8 parts per 150 of body weight, and in addition an equal amount should be divided between the peritoneal and the pleural cavities.

Embalming fluids should be controlled by examination by the proper authorities before being allowed to be used, and each proprietary preparation should bear upon its label the statement that it has been examined and approved by the proper authorities. In addition, examinations should be made from time to time of such fluids bought upon the open market to see that they conform to the approved formula.

This work is being continued in the laboratory, and it is hoped and believed that within the next three or four months results of a sufficiently conclusive character will have been reached to definitely recommend the minimum requirements for an approved disinfecting fluid; but in the meanwhile it is believed that if it is necessary to promulgate regulations as to what shall constitute an approved disinfecting fluid, the regulations should provide that at least 5 per cent or more by weight of formaldehyde gas be contained in such fluids.

Doctor Bracken. Mr. Chairman, I am led to speak of this again because I think that Minnesota has done a good deal of work along this line. The reason for that was that we had an embalmer in Minnesota who rather urged us into this work for our own State's benefit, and in doing our work we have accomplished certain things, and the information has gone out. I am glad that your department has taken up the work, and I hope it will reach results that can be used by the Conference of State and Provincial Boards of Health and the National Funeral Directors' Association. Originally we only required arterial embalming, but our last rules required both arterial and cavity embalming. I believe cavity embalming includes only infectious diseases. Doctor Anderson speaks of the percentage necessary to destroy germs. There is another very important point, and that is the economic feature. You have got to observe the economic feature. You can not use a formaldehyde fluid simply as such. Our regulations—and I will be glad to send you a copy of them—call for a fluid containing 5 per cent of formaldehyde by weight. That seemed the simplest way. The old regulations called for a percentage of an official preparation which was very vague. Other than that our present regulations exclude all free agents that you speak of that would interfere with the medico-legal work in the label business and chloral. The fluid No. 3, I will just say a word about that.

When we started in with this work Professor Franklin, of the department of chemistry, in submitting fluids, marked them 1, 2, and 3. All were formaldehyde fluids, but all had different ingredients. Fluid No. 3 was the most satisfactory. It has since been known simply as "fluid No. 3." The other two were simply thrown out, and that fluid has been approved by the conference as "an approved disinfectant." When we put our regulations into effect we based them rather on the laws relating to pure foods, and we required manufacturers to publish their formula—to put their printed formula on the bottle. The manufacturers objected to this and were ready to go into the courts and fight it out, and we backed down a little bit. We now ask the manufacturers to file with us a

list of ingredients, so that it will save our chemists a good deal of trouble in finding out the exact formula and list of ingredients of some of them. Some of the manufacturers have refused to do this, and they are not now doing business in our State. The fluid manufacturers took this matter up and maintained a capable chemist themselves and were ready to devote a considerable amount of money to investigating it. They said they wanted to get at all the facts. They also wanted to shove their bit in our mouths. Now we accept any fluid in our State where the manufacturers file with us a list of ingredients and where they will specify that it comes up to our standard of 5 per cent. Of course we will not take their word for the percentage of formaldehyde. We buy the fluids in open market and test them from time to time. If they are lower than standard, we warn the manufacturers; and if they continue lower, we tell them their fluid can not be sold in the State of Minnesota. The State Funeral Directors' Association has a list of fluids that can be used, so we can not confine ourselves to fluid No. 3.

The SURGEON-GENERAL. How often do you test them, Doctor?

Doctor BRACKEN. That depends entirely on the convenience of the laboratory. We do not test them at any specified time; just as the chemist finds it convenient from time to time to pick up samples and examine them. But the very fact that they are tested from time to time is a check upon them. We have simply provided for them a standard, and if they come up to the standard all right; but if a manufacturer falls below the standard he is notified that if he continues to fall below the fluid can not be sold in the State.

A MEMBER. Is that a chemical test, or biological also?

Doctor BRACKEN. Chemical test; we have no biological. Now, there were some undertakers in our State who did not want to use this because they were a little opposed to our way of doing things, and there is a manufacturer who puts up a No. 3 under a different name and they buy it.

A MEMBER. What is the percentage of formaldehyde in No. 3?

Doctor BRACKEN. Five and two-tenths it was originally—14 per cent of the 38 per cent—14 per cent of the official solution—that is, the United States Pharmacopœial formula. Then we wanted to get at it more exactly, and we made it 5 per cent.

A MEMBER. Five per cent of what?

Doctor BRACKEN. Five per cent of formaldehyde gas by weight.

Doctor SNOW. Doctor Anderson has said that cremation offers the best disinfectant, and I want to renew my question with just an illustration of why I ask it. Many of our citizens in California are citizens of Atlantic or Middle Western States, and many of them want to be returned after they die to their old family cemeteries. Recently a man came out from New York to get the body of his brother who

had died of cholera, as the local certificate showed, about 1870. He went to the railroad office, and wanted to leave that night on the Overland for New York, and the company would not take the body because the death certificate, which was made out here, stated the man died of cholera. So they telegraphed to me, and I said it was all right so far as I was concerned, only the law was specific and he might be held up on the way. So on my advice he telegraphed New York for special permission. I do not know what the subsequent history was. Now, suppose we had a death from bubonic plague, would it be possible, as an interstate measure, to ship a body which died of bubonic plague, provided cremation had been carried out? It seems to me this is rather a practical proposition.

A MEMBER. Would you call the ashes a body?

Doctor SNOW. Well, when the body gets back people want to put the body in the ground and have a demonstration and call it a body, and the sexton wants his slip. In our State I have ruled that cremated bodies should come under the same regulations as others regarding the filing certificates, etc. Otherwise I would lose track of a great many deaths. I do not know whether there is a general understanding or not on this question of exempting cremated bodies from all burial restrictions.

Doctor BRACKEN. I do not believe the regulations were meant to apply to ashes, and ashes can be shipped in a little tin box. Of course the tin box should be accompanied by a certificate of death, but I do not think that certificate need be carried to the end of the route. The people there can make a record of the death. That is all we want.

Doctor HILL. When we tried the effect of arterial injection on the skin, which would be a serious matter in cases of smallpox, we found the skin was not disinfected by the arterial disinfection. I made some inquiries in regard to the number of cases of smallpox contracted from dead bodies. I found I could get the history of only one case in Minnesota, and that was one where an embalmer was infected from a smallpox body, so that the only case I was able to trace to a body was this one case of smallpox, which would not have occurred but for this requirement of the regulations.

Doctor ANDERSON. In reply to the point raised as to why we used for a test germ the anthrax bacillus, I will say that the anthrax bacillus is never found in the spore form in the intact body after death, but is always in the vegetative form. This fact is taken advantage of in the disposal by burying of animals dead of anthrax, care being taken that the body is not open so that oxygen can gain access to the tissues, resulting in the organism entering into the spore

form. When these precautions are observed anthrax is as good a test organism, and it is no more resistant than the typhoid bacillus.

The SURGEON-GENERAL. I would like to appoint a committee upon this subject to report at the next meeting. They could confer with Doctor Cofer, on the part of the bureau, in the meantime. I will appoint Doctors Bracken, Batt, Porter, Townsend, and Sumner.

Now, gentlemen, unless there is some other matter you would like to bring up, the programme is completed. We are through with the subjects we wanted to discuss with you.

Doctor SWARTS. Is this committee for testing fluids or transportation?

The SURGEON-GENERAL. No. It is for transportation. The experiments will still go on in the laboratory, and they will be available for the use of this committee.

Now, gentlemen, before declaring the conference adjourned, there is one little matter I think it is pertinent to speak of—not that I lay very much stress upon it, but I think it is just as well I should mention it; and that is in the last few days you have received some impressions with regard to the conduct of the service in 1900 and 1901. I do not care to lay very much stress upon it, but still mistakes might be made, and I believe I am justified in simply stating, with regard to the departmental action at that time, there was no disposition on the part of the department, the Secretary, the Assistant Secretary, or President McKinley to be overbearing, or to suppress, or to attempt to dictate in the management of affairs at that time.

With regard to the supposed carrying of bubonic plague from San Francisco by the steamer *Curacao* in 1902, I have looked into that; in fact, I had the matter very carefully examined into through our officer in San Francisco and through the United States consul at Mazatlan, and the report of the consul showed that without doubt there was no human case of bubonic plague carried to Mazatlan—that is to say, that the epidemic in Mazatlan did not spring from an imported human case; in all probability it came from some infected rat or vermin in the freight of some steamer. Now, as to what steamer it was it would be impossible to state. It might have been the *Curacao*, or some German steamer which plied on the east coast of South America and then came around to the west coast and stopped at several South American cities and then came to Mazatlan. The *Curacao* at that time had been making those trips constantly, and we feel now that the bubonic plague had been for a number of years, in San Francisco, since 1897 it has been intimated, undiscovered, unrecognized for all that time. That the *Curacao* carried the disease from San Francisco to Mazatlan can not be proven, and I think the probability is that it did not. That was my conclusion at the time. Moreover, with regard to giving notice and violation

of a treaty, there was no real treaty between the United States and Mexico at that time.

There was a resolution passed in a conference participated in by the United States and Mexico, but it was merely a resolution, and involved practices which in some governments could be carried out, where the governments represented were central in character, but the sanitary authorities of San Francisco were the local board of health; and so far as announcements were concerned, the announcement had been freely made, and continuously made every week, and spread out on the pages of the Public Health Reports for a year previous to and including that time, and properly sent out. Another assertion is that the commercial interests had inspired the President and we were ordered to take off quarantine; that we had to do it by order of the President and Secretary of the Treasury. That is entirely incorrect. There was at the time quite some feeling with regard to the plague situation, and Governor Gage was very annoying, constantly importuning the Secretary of the Treasury and the President, but none of this had any influence at all. But about that time there was a good deal of trouble about the quarantine established by the local board of health, and it was declared to be illegal by the court. In the meantime I had sent officers to the borders of the State to enforce interstate quarantine. This I regarded at the time as more of a precautionary measure. I did not know but that a great outbreak of plague was to follow, but on account of legal complications, and no outbreak occurring, and without influence of the President or the Secretary of the Treasury, I took off this inspection and it has never been put back. I do not want to discuss this in particular, but I only thought I would like to relieve the impression that we were overruled by the President or the department at that time, which was not the case.

Well, gentlemen, I feel very thankful to you for your attendance here. I was a little afraid that after the two days of your meeting of the State and Provincial Boards of Health you might feel too tired to come, and your attendance in such large numbers is especially gratifying. I trust that as matters go on we will have closer relations. It is my desire, and as soon as we get our status improved in law I am sure there will be many more of these conferences; not necessarily like the annual conference, but from time to time I hope to meet groups of you, and it need not necessarily be here. Sometimes it might be here and sometimes it might be elsewhere where I might get the benefit of your advice, just as we are asking for it now, with regard to certain measures that we want to put into our regulations. I think everything is going on for the better, and believe this annual conference has demonstrated the growth in the importance of the state boards of health, and how the efficiency of the state boards has increased. In any

organization, as I have stated repeatedly, relating to the management of the public health in the United States, I consider the state boards of health the prime factor, and I think you will bear me out from the correspondence you have had with me that I have done and always will do all that I can to maintain their dignity and importance. I repeatedly receive requests from Congressmen, and have had requests direct from municipalities, for an expert or for assistance. Invariably I refer the matter first to the state board of health and will not take action unless I have the cordial assent of the state board. I think that is the correct principle, and I have done all I can and will always do all I can to strengthen the state boards of health in their own States. With these few remarks and thanking you again for your attendance, I declare this conference adjourned.

APPENDIX.

State and Territorial Health Authorities in the United States.

[Corrected September 30, 1910.]

Alabama:

W. H. Sanders, M. D., state health officer, Montgomery.

E. M. Mason, M. D., state bacteriologist and pathologist, Montgomery.

G. W. Williamson, M. D., registrar of vital and mortuary statistics, Montgomery.

Note.—Under the laws of Alabama the medical association of the State constitutes the state board of health. A standing committee, called the state committee of public health, is authorized to act for the state board of health during the intervals of the sessions.

Alaska:

(Alaska has no district board of health.)

Arizona:

Territorial board of health—

Governor Richard E. Sloane, president, Phoenix.

Attorney-General J. B. Wright, Tucson.

Edward S. Godfrey, jr., M. D., secretary and superintendent of public health, Phoenix.

Arkansas:

State board of health—

J. P. Runyan, M. D., president, Little Rock.

J. P. Sheppard, M. D., secretary, Little Rock.

John R. Dibrell, M. D., Little Rock.

R. S. Hilton, M. D., El Dorado.

B. L. Harrison, M. D., Jonesboro.

E. H. Abingdon, M. D., Beebee.

California:

State board of health—

Martin Regensburger, M. D., president, San Francisco.

W. Le Moyne Wills, M. D., vice-president, Los Angeles.

Wallace A. Briggs, M. D., Sacramento.

F. K. Ainsworth, M. D., San Francisco.

O. Stansbury, M. D., Chico.

Wm. F. Snow, M. D., secretary, Sacramento.

James H. Parkinson, M. D., Sacramento.

Colorado:

State board of health—

V. R. Pennock, M. D., president, Longmont.

L. E. Lemen, M. D., vice-president, Denver.

Hugh L. Taylor, M. D., secretary and executive officer, Denver.

Crum Epler, M. D., treasurer, Pueblo.

George C. Stemen, M. D., Denver.

J. N. Hall, M. D., Denver.

Minnie C. T. Love, M. D., Denver.

B. F. Wooding, M. D., Denver.

Paull S. Hunter, M. D., Denver.

Connecticut:

State board of health—

Edward K. Root, M. D., president, Hartford.
Joseph H. Townsend, M. D., secretary; office at Hartford.
T. H. McKenzie, C. E., Southington.
Lewis Sperry, esq., South Windsor.
Albert W. Phillips, M. D., Derby.
Arthur J. Wolff, M. D., Hartford.
Louis J. Pons, M. D., Roxbury.

Delaware:

State board of health—

J. W. De Witt, M. D., president, St. Georges.
J. A. Draper, M. D., Wilmington.
J. W. Clifton, M. D., Smyrna.
W. F. Haines, M. D., Seaford.
W. P. Orr, M. D., Lewes.
W. F. Davis, M. D., Dover.
A. E. Frantz, M. D., secretary and executive officer, Wilmington.

Florida:

State board of health—

E. M. Hendry, president, Tampa.
H. L. Simpson, M. D., Pensacola.
John G. Christopher, Jacksonville.
Joseph Y. Porter, M. D., state health officer and secretary state board of health, Jacksonville and Key West.

Georgia:

State board of health—

W. F. Westmoreland, M. D., president, Atlanta.
Charles Hicks, M. D., vice-president, Dublin.
H. F. Harris, M. D., secretary and director of laboratories, Atlanta.
W. W. Owens, M. D., Savannah.
A. P. Taylor, M. D., Thomasville.
M. S. Brown, M. D., Fort Valley.
James H. McDuffie, M. D., Columbus.
Howard J. Williams, M. D., Macon.
R. M. Harbin., M. D., Rome.
Samuel C. Benedict, M. D., Athens.
Giles Hathcock, M. D., Belton.
J. B. Morgan, M. D., Augusta.

Hawaii:

Territorial board of health—

E. A. Mott-Smith, president.
Alexander Lindsay, jr.
F. C. Smith.
D. Kalauokalani.
Jas. F. Morgan.
W. D. Baldwin, M. D.
W. C. Hobdy, M. D.
K. B. Porter, secretary, Honolulu.

Idaho:

State board of health—

Geo. E. Hyde, M. D., president, Rexburg.
Ralph Falk, M. D., secretary, Boise.
J. C. Coulthard, M. D., Idaho Falls.
Attorney-General D. C. McDougall.
D. C. Martin, state engineer.
C. D. Mason, state chemist, Boise.
J. H. Wallis, dairy, food, and sanitary inspector, Boise.

Illinois:

State board of health—

George W. Webster, M. D., president, Chicago.
Charles J. Boswell, M. D., Mounds.
R. E. Niedringhaus, M. D., Granite City.
Walter R. Schussler, M. D., Orland.
P. H. Wessel, M. D., Moline.
Henry Richings, M. D., Rockford.
James A. Egan, M. D., secretary and executive officer, Springfield.

Indiana:

State board of health—

Geo. T. McCoy, M. D., president, Columbus.
W. N. Wishard, M. D., vice-president, Indianapolis.
T. Henry Davis, M. D., Richmond.
Fred A. Tucker, M. D., Noblesville.
J. N. Hurty, M. D., Phar. D., secretary, Indianapolis.

Iowa:

State board of health—

Attorney-General H. W. Byers, Des Moines.
Paul O. Koto, M. D. C., state veterinarian, Des Moines.
Lafayette Higgins, C. E., Des Moines.
A. P. Hanchett, M. D., Council Bluffs.
A. C. Moerke, M. D., Burlington.
B. L. Eiker, M. D., Leon.
G. E. Decker, M. D., Davenport.
Albert De Bey, M. D., Orange City.
T. U. McManus, M. D., Waterloo.
E. E. Richardson, M. D., Webster City.
Guilford H. Sumner, M. D., secretary, Des Moines.
Henry Albert, M. D., director bacteriological laboratory, Iowa City.
Prof. C. N. Kinney, chemist, Des Moines.

Kansas:

State board of health—

Clay E. Coburn, M. D., president, Kansas City.
C. H. Lerrigo, M. D., Topeka.
B. J. Alexander, M. D., Hiawatha.
V. C. Eddy, M. D., Colby.
J. B. Carver, M. D., Fort Scott.
C. S. Huffman, M. D., Columbus.
J. A. Milligan, M. D., Garnett.
H. L. Aldrich, M. D., Caney.
W. O. Thompson, M. D., Dodge City.
C. D. Welch, attorney, Coffeyville.
S. J. Crumbine, M. D., secretary, Topeka.

Members of the advisory board—

F. O. Marvin, A. M., Mem. Am. Soc. C. E., sanitary adviser, Lawrence.
William C. Hoad, B. S., Asso. Mem. Am. Soc. C. E., sanitary and civil engineer, Lawrence.
E. H. S. Bailey, Ph. D., chemist, State University, Lawrence, food analyst for board.
J. T. Willard, M. S., Agricultural College, Manhattan, food analyst for the board.
L. E. Sayre, Ph. M., State University, Lawrence, director of drug analysis.
R. S. Magee, M. D., pathologist, Topeka.
Sara E. Greenfield, M. D., bacteriologist, Topeka.
W. J. V. Deacon, statistician, Topeka.
S. C. Emley, A. M., M. D., lecturer, Lawrence.

Kentucky:

State board of health—

William Bailey, M. D., president, Louisville.
H. S. Keller, M. D., Frankfort.
John G. South, M. D., Frankfort.
William A. Quinn, M. D., Henderson.
C. Z. Aud, M. D., Cecilian.
K. W. Coffman, M. D., Owensboro.
J. C. Mitchell, M. D., Louisville.
J. N. McCormack, M. D., secretary, Bowling Green.

Louisiana:

State board of health—

Oscar Dowling, M. D., president, Caddo Parish.
Beverly W. Smith, M. D., vice-president, St. Mary Parish.
T. T. Tarlton, M. D., St. Landry Parish.
Herman Oechsner, M. D., Orleans Parish.
G. W. Gaines, M. D., Madison Parish.
B. A. Ledbetter, M. D., Orleans Parish.
Thos. A. Roy, M. D., Avoyelles Parish.
E. S. Kelly, M. D., secretary, Orleans Parish.
Sidney D. Porter, M. D., medical inspector, Avoyelles Parish.
H. P. Jones, M. D., food commissioner, Orleans Parish.
George B. Taylor, analyst, Orleans Parish.
P. E. Archinard, M. D., bacteriologist, Orleans Parish.

Maine:

State board of health—

Charles D. Smith, M. D., president, Portland.
E. C. Jordan, C. E., Portland.
G. M. Woodcock, M. D., Bangor.
Richard H. Stubbs, M. D., Augusta.
A. G. Young, M. D., secretary, Augusta.

Maryland:

State board of health—

William H. Welch, M. D., president, Baltimore.
Marshall Langton Price, M. D., secretary, Baltimore.
Howard Bratton, M. D., Elkton.
James Bosley, M. D., commissioner of health of Baltimore City (ex officio), Baltimore.
Douglas H. Thomas, jr., Baltimore.
Attorney-General Isaac Lobe Straus (ex officio), Baltimore.
Louis A. Griffith, M. D., Upper Marlboro.

Massachusetts:

State board of health—

Henry P. Walcott, M. D., chairman, Cambridge.
Julian A. Mead, M. D., Watertown.
Hiram F. Mills, C. E., Lawrence.
Gerard C. Tobey, esq., Wareham.
James W. Hull, Pittsfield.
Charles H. Porter, Quincy.
Robert W. Lovett, M. D., Boston.
Mark W. Richardson, M. D., secretary, Boston.

Michigan:

State board of health—

Angus McLean, M. D., president, Detroit.
Malcolm C. Sinclair, M. D., vice-president, Grand Rapids.
Frank W. Shumway, M. D., secretary, Lansing.
Aaron R. Wheeler, M. D., St. Louis.
Victor C. Vaughan, M. D., Ann Arbor.
Charles M. Ranger, A. B., Battle Creek.
Charles A. Blake, Detroit.

Minnesota:

State board of health—

Henry Hutchinson, M. D., president, St. Paul.
H. M. Bracken, M. D., secretary and executive officer, St. Paul.
O. T. Sherping, M. D., Fergus Falls.
C. Graham, M. D., Rochester.
F. N. Hunt, M. D., Blue Earth.
J. A. Quinn, M. D., St. Paul.
C. W. Moore, M. D., Eveleth.
W. A. Jones, M. D., vice-president, Minneapolis.
B. J. Merrill, M. D., Stillwater.

Laboratory division—

F. F. Wesbrook, M. D., director.

Epidemiological division—

H. W. Hill, M. D., director.

Engineering division—

F. H. Bass, B. S., director.

Mississippi:

State board of health—

E. C. Coleman, M. D., president, Kosciusko.
B. A. Shepherd, M. D., Lexington.
D. J. Williams, M. D., Ellisville.
S. H. McLean, M. D., secretary, Jackson.
John Darrington, M. D., Yazoo City.
T. E. Ross, M. D., Hattiesburg.
G. S. Bryan, M. D., Amory.
L. D. Dickerson, M. D., McComb City.
W. L. Little, M. D., Wesson.
E. A. Cheek, M. D., Arcola.
W. W. Mathis, M. D., Orwold.
J. W. Crumpton, M. D., Starkville.
I. W. Cooper, M. D., Newton.

Missouri:

State board of health—

A. N. Hamel, M. D., president, 3589 Arsenal street, St. Louis.
Ira W. Upshaw, M. D., vice-president, 5015 Shaw avenue, St. Louis.
Frank S. Hiller, M. D., secretary, Jefferson City.
Ernest F. Robinson, M. D., 603 Bryant Building, Kansas City.
J. A. B. Adcock, M. D., Warrensburg.
L. E. Bunte, M. D., 2003 North Market street, St. Louis.
Frank B. Fuson, M. D., Springfield.

Montana:

State board of health—

Governor Edwin L. Norris, Helena.
Attorney-General Albert J. Galen, Helena.
William Treacy, M. D., president, Helena.
Thomas D. Tuttle, M. D., secretary, Helena.
M. E. Knowles, D. V. S., state veterinarian, Helena.
C. T. Pigott, M. D., Roundup.
D. J. Donohue, M. D., Glendive.

Nebraska:

State board of health—

C. P. Fall, M. D., president, Beatrice.
H. B. Cummins, M. D., vice-president, Seward.
A. L. Muirhead, M. D., treasurer, Omaha.
E. Arthur Carr, M. D., secretary, Lincoln.
W. H. Wilson, M. D., state health inspector, Lincoln.

Nevada:

State board of health—

S. C. Gibson, M. D., vice-president, Reno.
Jno. J. Sullivan, M. D., Virginia City.
S. L. Lee, M. D., secretary, Carson City.

New Hampshire:

State board of health—

Governor Henry B. Quinby, Laconia.
Attorney-General E. B. Eastman, Exeter.
G. P. Conn, M. D., president, Concord.
Chas. S. Collins, M. D., Nashua.
Robert Fletcher, C. E., Hanover.
Irving A. Watson, M. D., secretary, State House, Concord.

Laboratory of hygiene—

Irving A. Watson, M. D., director, Concord.
Chas. D. Howard, B. S., chemist, Concord.
Waldo L. Adams, B. S., assistant chemist, Concord.
H. N. Kingsford, M. D., bacteriologist in charge, Hanover and Concord.
Charles Duncan, M. D., bacteriologist, Concord.
Geo. S. Graham, M. D., assistant bacteriologist, Hanover.
W. S. Purrington, B. S., inspector, Concord.

New Jersey:

State board of health—

John H. Capstick, president, Boonton.
Bruce S. Keator, M. D., secretary, Ashury Park.
George P. Alcott, East Orange.
H. M. Herbert, Bound Brook.
William H. Chew, Camden.
Herbert W. Johnson, Haddonfield.

New Mexico:

Territorial board of health and medical examiners—

J. F. Pearce, M. D., president, Albuquerque.
W. E. Kaser, M. D., vice-president, Las Vegas.
J. A. Massie, M. D., secretary, Santa Fe.
Wm. D. Radcliffe, M. D., treasurer, Belen.
T. B. Hart, M. D., Raton.
F. F. Doepp, M. D., Carlsbad.
J. G. Moir, M. D., Deming.

NEW YORK:

State department of health—

Eugene H. Porter, A. M., M. D., commissioner.

Division of administration—

Wm. A. Howe, M. D., deputy commissioner.

Alec H. Seymour, secretary.

Division of sanitary engineering—

Theodore Horton, C. E., chief engineer.

H. B. Cleveland, C. E., principal assistant engineer.

H. N. Ogden, C. E., special assistant engineer.

C. A. Holmquist, C. E., assistant sanitary engineer.

A. O. True, inspecting engineer.

Division of laboratory work—

Wm. S. Magill, M. D., director state antitoxin and hygienic laboratories.

Thomas Ordway, M. D., director Bender Laboratory.

H. R. Gaylord, M. D., director Cancer Laboratory.

L. M. Wachter, chief sanitary chemist.

W. A. Bing, assistant bacteriologist.

Division of vital statistics—

F. D. Beagle, director.

Division of publicity and education—

Hills Cole, M. D., director.

Consulting staff—

Herbert D. Schenck, M. D., ophthalmologist.

Frederic C. Curtis, M. D., dermatologist.

Harlan P. Cole, M. D., orthopedist.

Walter F. Willcox, Ph. D., statistician.

John B. Garrison, M. D., laryngologist.

Tuberculosis advisory board—

Edward R. Baldwin, M. D., Saranac Lake.

Thomas Darlington, M. D., New York City.

Livingston Farrand, M. D., New York City.

Homer Folks, esq., New York City.

Willis G. MacDonald, M. D., Albany.

Alfred Meyer, M. D., New York City.

Veranus A. Moore, M. D., Ithaca.

John H. Pryor, M. D., Buffalo.

William H. Watson, M. D., Utica.

John L. Heffron, M. D., Syracuse.

NORTH CAROLINA:

State board of health—

George G. Thomas, M. D., president, Wilmington.

Thomas E. Anderson, M. D., Statesville.

J. Howell Way, M. D., Waynesville.

W. O. Spencer, M. D., Winston-Salem.

Edward C. Register, M. D., Charlotte.

David T. Tayloe, M. D., Washington.

J. E. Ashcraft, M. D., Monroe.

J. L. Ludlow, C. E., Winston-Salem.

Richard H. Lewis, M. D., Raleigh.

W. S. Rankin, M. D., secretary and treasurer, Raleigh.

C. A. Julian, M. D., assistant secretary for tuberculosis.

John A. Ferrell, M. D., assistant secretary for hookworm disease, Raleigh.

North Dakota:

State board of health—

Attorney-General Andrew Miller, president, Bismarck.
C. E. Bennett, M. D., vice-president, Aneta.
J. Grassick, M. D., secretary, Grand Forks.

Ohio:

State board of health—

Wm. T. Miller, M. D., president, Cleveland.
Frank Warner, M. D., vice-president, Columbus.
Josiah Hartzell, Ph. D., Canton.
John W. Hill, C. E., Cincinnati.
J. C. Crossland, M. D., Zanesville.
C. O. Probst, M. D., secretary and executive officer, Columbus.
R. Winthrop Batt, chief engineer, Columbus.
Burt Ransom Rickards, chief of laboratories, Columbus.

Oklahoma:

State board of health—

J. C. Mahr, M. D., state commissioner of health, Oklahoma City.
Prof. Edwin De Barr, chemist, director of board of health laboratory.
Prof. L. A. Turley, bacteriologist.
D. E. Jenner, chief clerk.
R. H. Riley, statistical clerk.
U. S. Russell, A. J. Emery, and H. O. Tener, food inspectors.
C. B. Bellamy, drug inspector.

Oregon:

State board of health—

W. B. Morse, M. D., president, Salem.
Andrew C. Smith, M. D., vice-president, Portland.
Alfred Kinney, M. D., Astoria.
E. A. Pierce, M. D., Portland.
C. J. Smith, M. D., Pendleton.
E. B. Pickel, M. D., Medford.
Calvin S. White, M. D., secretary and state health officer, Portland.
Emile F. Pernot, M. S., bacteriologist, Portland.
W. H. Lytle, veterinarian, Pendleton.

Pennsylvania:

State department of health—

Samuel G. Dixon, M. D., LL. D., commissioner of health, Harrisburg.
Benjamin Lee, M. D., assistant to commissioner, Harrisburg.
Wilbur Morse, secretary, Harrisburg.
B. Franklin Royer, M. D., chief medical inspector, Harrisburg.
Charles J. Hunt, M. D., associate chief medical inspector, Harrisburg.
Wilmer R. Batt, M. D., registrar of vital statistics, Harrisburg.
Fred C. Johnson, M. D., medical director, Pennsylvania South Mountain Sanatorium for Tuberculosis, Mont Alto.
Thos. H. A. Stites, M. D., medical inspector of dispensaries, Harrisburg.
John A. Bouse, M. D., special medical inspector on organization of local boards of health, Harrisburg.
F. Herbert Snow, chief engineer, Harrisburg.
Henry W. Peirson, chief of the division of distribution of biological products, Harrisburg.
Herbert Fox, M. D., chief of the department of health laboratories, University of Pennsylvania, Philadelphia.

PENNSYLVANIA—Continued.

Advisory board—

Adolph Koenig, M. D., Pittsburg.
Lee Masterson, C. E., Johnstown.
Charles B. Penrose, M. D., Philadelphia.
B. H. Warren, M. D., West Chester.
George W. Guthrie, M. D., Wilkes-Barre.

PORTO RICO:

Dr. Felipe B. Cordero, supervisor of health.

Superior board of health—

Dr. Felipe B. Cordero, chairman.
Dr. José E. Saldaña, physician.
Lcdo. Francisco de P. Acuña, legal adviser.
Lcdo. Rafael Monagas, pharmacist.
Rafael del Valle Zeno, C. E., engineer.

Medical inspectors—

Northern district: Dr. Víctor Gutiérrez Ortiz, San Juan.
Southern district: Dr. Félix García de la Torre, Ponce.

Veterinary inspectors—

Dr. Thos. A. Allen, San Juan.
Dr. Juan Varas, Ponce.

Inspectors of plumbing—

Rafael Palés Díaz.
Domingo W. Palés.

Chemico-bacteriological laboratory—

Lcdo. Rafael del Valle Sárraga, director.
Lcdo. Vasco Belaval, assistant chemist.

Food inspectors—

First district: Juan Torres, San Juan.
Second district: Carlos Abella, Mayagüez.
Third district: Lcdo. Lorenzo Mascaró, Ponce.
Fourth district: Alejandro Díaz, Humacao.

Sanitary inspectors—

Vicente Andino.
Enrique Ronda.

Tropical and transmissible diseases service—

Dr. Pedro Gutiérrez Ygaravídez, director, San Juan.
Dr. Francisco J. Hernández, assistant director.

Bacteriological laboratory—

Dr. Isaac González Martínez, bacteriologist.
Dr. Francisco Hernández, sanitary officer, San Juan.
Dr. Miguel Roses Artau, sanitary officer, Arecibo.
Dr. B. Jiménez Serra, sanitary officer, Aguadilla.
Dr. Marcos A. Manzano, sanitary officer, Mayagüez.
Dr. Alfredo Ferrán, sanitary officer, Ponce.
Dr. Eulalio García Lascot, sanitary officer, Humacao.
Dr. A. Ruiz Soler, sanitary officer, Cayey.

RHODE ISLAND:

State board of health—

Alexander B. Briggs, M. D., president, Ashaway.
Samuel M. Gray, C. E., Providence.
Rev. George L. Locke, Bristol.
Rufus E. Darrah, M. D., Newport.
Gardner T. Swarts, M. D., secretary, Providence.
James O'Hare, Ph. C., Providence.
John H. Bennett, M. D., Pawtucket.
R. Morton Smith, M. D., Riverpoint.

South Carolina:

State board of health—

Robert Wilson, jr., M. D., chairman, Charleston.
H. T. Hall, M. D., Aiken.
C. C. Gambrell, M. D., Abbeville.
E. A. Hines, M. D., Seneca.
W. J. Burdell, M. D., Lugoff.
William Egleston, M. D., Hartsville.
W. M. Lester, M. D., Columbia.
Comptroller-General A. W. Jones, Columbia.
Attorney-General J. Fraser Lyou, Columbia.
Dr. W. W. Dodson, pharmaceutical member, Laurens.
C. F. Williams, M. D., secretary and state health officer, Columbia.

South Dakota:

State board of health—

W. H. Lane, M. D., president, Miller.
R. T. Dott, M. D., vice-president, Salem.
O. N. Hoyt, M. D., superintendent and secretary, Pierre.
W. L. Vercoe, M. D., Lead.
Park L. Jenkins, M. D., Waubay.

Tennessee:

State board of health—

T. E. Abernathy, M. D., president, Chattanooga.
Louis Leroy, M. D., vice-president, Memphis.
R. E. Fort, M. D., Nashville.
Hon. John Thompson, Nashville.
J. A. Albright, secretary and executive officer, Nashville.
John S. Hamel, assistant to the secretary, Nashville.
Olin West, M. D., assistant secretary for the eradication of hookworm disease.
William Litterer, M. D., state bacteriologist, Nashville.
Lucius P. Brown, pure food and drugs inspector, Nashville.

Texas:

State board of health—

W. M. Brumby, M. D., president and state health officer, Austin.
T. F. Burnett, M. D., Seymour.
John W. Burns, M. D., Cuero.
Boyd Cornick, M. D., San Angelo.
H. W. Cummins, M. D., Hearne.
J. E. Gilcreest, M. D., Gainesville.
J. Mark O'Farrell, M. D., Richmond
Clyde D. Smith, secretary, Austin.

Utah:

State board of health—

F. S. Bascom, M. D., president, Salt Lake City.
W. R. Calderwood, M. D., Salt Lake City.
D. O. Miner, M. D., Nephi.
Fred Stauffer, M. D., Salt Lake City.
A. F. Doremus, C. E., Salt Lake City.
T. B. Beatty, M. D., secretary, Salt Lake City.
H. K. Merrill, M. D., Logan.

Vermont:

State board of health—

C. S. Caverly, M. D., president, Rutland.
H. D. Holton, M. D., secretary, Brattleboro.
F. Thomas Kidder, M. D., Woodstock.

Virginia:

State department of health, office and laboratories, 1110 Capitol street, Richmond.

Ennion G. Williams, M. D., health commissioner.
Allen W. Freeman, M. D., assistant commissioner.
Meade Ferguson, Ph. D., bacteriologist.
A. Lambert Martin, clerk.

Board of health—

R. W. Martin, M. D., president.
W. M. Smith, M. D., secretary.
S. W. Hobson, First Congressional District, Newport News.
Stanley H. Graves, M. D., Second Congressional District, Norfolk.
J. B. Fisher, M. D., Third Congressional District, Midlothian.
O. C. Wright, M. D., Fourth Congressional District, Jarratts.
Lewis E. Harvie, M. D., Fifth Congressional District, Danville.
R. W. Martin, M. D., Sixth Congressional District, Lynchburg.
T. C. Firebaugh, M. D., Seventh Congressional District, Harrisonburg.
W. M. Smith, M. D., Eighth Congressional District, Alexandria.
J. H. Dunkley, M. D., Ninth Congressional District, Saltville.
Reid White, M. D., Tenth Congressional District, Lexington.
Geo. Ben Johnston, M. D., city of Richmond.
Stuart McGuire, M. D., city of Richmond.

Washington:

State board of health—

Wilson Johnston, M. D., president, Spokane.
Elmer E. Heg, M. D., secretary, Seattle.
James R. Yocom, M. D., Tacoma.
Edwin L. Kimball, M. D., Spokane.
S. B. Nelson, D. V. S., Pullman.
P. Frank, M. D., North Yakima

West Virginia:

State board of health—

John L. Dickey, M. D., president, Wheeling.
C. W. Halterman, M. D., Clarksburg.
L. S. Brock, M. D., Morgantown
A. R. Warden, M. D., Grafton.
M. V. Godbey, M. D., Charleston.
J. E. Robins, M. D., Claremont.
A. N. Frame, M. D., Parkersburg
H. M. Rymer, M. D., Harrisville.
R. E. Vickers, M. D., Huntington.
H. A. Barbee, M. D., secretary and executive officer, Point Pleasant.

Wisconsin:

State board of health—

Wm. F. Whyte, M. D., president, Watertown.
C. H. Sutherland, M. D., Janesville.
E. S. Hayes, M. D., Eau Claire.
L. E. Spencer, M. D., Wausau.
Hasso A. Meilike, M. D., Clintonville.
C. A. Harper, M. D., secretary and executive officer, Madison.
Lawrence P. Mayer, M. D., Hudson.

Wyoming:

State board of health—

Fred Horton, M. D., president, Newcastle.
A. W. Barber, M. D., secretary and executive officer, Cheyenne.
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STUDIES UPON LEPROSY

XII. NOTES ON THE STUDY OF HISTORIES OF LEPERS FROM THE STANDPOINT OF TRANSMISSION

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XIII. A CONTRIBUTION TO THE STUDY OF RAT LEPROSY

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NOTES ON THE STUDY OF HISTORIES OF LEPERS FROM THE STANDPOINT OF TRANSMISSION.

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INTRODUCTION.

The most simple method which is employed for the eradication of most communicable diseases is the removal of the affected member from its healthy fellows.

In the case of certain diseases among the lower animals (glanders, tuberculosis, fowl cholera, etc.) this is effected by killing the diseased animal and destroying its carcass.

In the case of human beings the nearest approach to this method that humanitarian ideals will permit is the complete isolation of the diseased person from his fellows until the course of illness has terminated. When we are dealing with typhus or smallpox, this isolation is comparatively easy to effect, as the separation of the sick from relatives and friends is of short duration; but when we attempt to employ this method in the case of a disease in which, like leprosy, the duration of the illness is for the balance of the individual's life, we meet with the resistance of friends and relatives, who, in many cases, prefer to take a serious risk of contracting the disease themselves rather than to surrender the ill to what they know means lifelong and complete separation.

This is especially true when we are dealing with a people that only partially accept our teachings of the communicability of disease; especially true when the system of isolation appears to them to be unnecessarily complete in character; especially true when we deal with a people whose loyalty to family and race is better developed than any abstract ideals of upholding the law for the ultimate benefit of all.

In our present state of knowledge of leprosy it is difficult to see how we can ever hope to eradicate this disease without some form of isolation. We can not say just how complete such isolation must be to effect the results desired, as we do not know how man contracts the

disease, except that he acquires it in some unknown manner, directly or indirectly, from some other person afflicted with it. But as our knowledge of transmission in other diseases has increased, our methods of eradication have, as a rule, not only become more effective, but also more humane, and it is safe to say that leprosy will be no exception to this rule.

Even in our present state of knowledge, certain countries, notably Norway, have developed a system of isolation which, at first sight, hardly appears strict enough to be termed isolation, yet this very country has practically stamped out leprosy by no other measures than the one referred to. On the other hand, in countries like Hawaii, where those apprehended are completely banished, absolute failure to lessen the incidence of the disease has resulted, not because the banishment of *all* cases would not eradicate the disease, but because the isolation is made so complete that the relatives of the afflicted refuse to comply with the spirit of the law and report their sick.

In the case of Norway the cooperation of the people has been secured by instituting a modified form of isolation; in the case of Hawaii the cooperation of the people has not been secured, on account of the absolute character of the isolation.

Just how completely must we isolate a leper from his fellows to make the latters' infection a remote possibility? An exact answer to this question can only be given when we have an exact knowledge of the means whereby we acquire the disease from those afflicted with it.

Now that we can grow the bacillus of leprosy on artificial media we may hope to be able to approach the subject of transmission by a direct method of study. Nevertheless, for the present at least, indirect means of studying the problem will continue to offer hope for its solution.

Of these indirect methods of studies of this problem there are few which offer more promise in illuminating the subject of transmission than that of case study—the study of the histories of lepers for the few years preceding the first symptoms of the disease.

It must be admitted, however, that the value of such evidence depends largely upon the locality. Those places where cases of leprosy are few offer a better opportunity than places where the reverse holds true, for the reason that in the former case, when we can trace a contact, of a certain character, with a leper several years before the disease develops in the patient whose history we are investigating, it becomes reasonably certain that that patient contracted leprosy from the person referred to and during the contact described.

On the other hand, when we obtain a history in a locality so badly afflicted with the disease that the patient knows that he or she has been in contact with a leper two, three, or half a dozen times, we must

presume that there have also been many unknown exposures, which makes it impossible to judge just when and by what kind of contact the disease was contracted.

It will be seen by the study of these notes that we are attempting to investigate the disease in one of the least favorable countries for such transmission studies, some of our cases having been exposed intimately, to their knowledge, several times, but even such data have their value.

As to the accuracy of the histories themselves, this is obviously most important in data of this character. We believe that the data we present here are as accurate as the average clinical history obtained elsewhere. None of the data presented here were given until we had thoroughly questioned and in some cases cross-questioned the patient after an interval of several weeks, keeping only those answers which were borne out by the further testimony of the patient.

In this connection it is hardly necessary to point out that when the average patient states that he was in contact with a certain disease at a certain time, even though the patient may be truthful, he may have erred, usually not being an expert diagnostician; but from its frequency Hawaiians have learned to know the symptoms of leprosy fairly well, probably being as familiar with them as the average person of the same class in other countries is familiar with the symptoms of pulmonary tuberculosis.

Another point to be borne in mind when considering these histories is the fear that these patients entertain that evidence of this character may be used to apprehend and isolate relatives and friends, now at large and known to the patient as suffering from leprosy. We have done all in our power to assure them that no such use would be made of such data, but this defect, of course, does not detract from the statements that they *were* exposed to a certain case at a certain time. The only way that it could influence the histories would be to withhold some statement bearing on an exposure, which they feared would be against the interest of some relative or friend.

The following histories were obtained either from patients under our care or from such under the care of the territorial board of health.

Case 1: Patient is about 18 years of age. He does not remember just how long he has had leprosy, but knows that he had the first symptoms before he entered school. At the time that he sickened some ten persons were living with him; three of these people had leprosy at that time. He does not know how long these people had suffered from leprosy, but knows that they had the disease for several years previous to the development of his first symptom. One of these persons is his father, who still lives in Honolulu. The other two are cousins. Both of these cousins have since been isolated. One of them

was sent over to the settlement at the time the patient was. After developing the disease, the patient entered a Honolulu boarding school. He did not know of any leper being at this boarding school at that time, except himself. Since patient was isolated, however, one of his former schoolmates has been sent into isolation. This schoolmate not only attended school with patient, but slept in the same bed with him, sat beside him, and often played with him. All of this occurred, as before stated, after "Case 1" knew that he was suffering from the disease.

The first symptoms patient noticed were red spots on his cheeks. Up to the time that he was isolated he never saw a leper that he knows of, except the three persons living in the same house with him. He has brothers and sisters, who are well; no relative other than the two cousins has ever been sent to isolation.

When he entered isolation he found a leper there whom he had known in Honolulu before the former developed leprosy, but there is no history of intimate contact with this case. He has had what he believed to be itch, but only *after* he developed leprosy. He was vaccinated while at school, i. e., *after* he developed leprosy.

CASE 2: Patient is 56 years of age; a Hawaiian of intelligence; has had leprosy for the last three years. His first symptoms were red spots on his forehead. He gives the following history of known exposures to the disease: He lived in the house with his father, who had leprosy and died of this disease in 1886. His father suffered from this disease for three (?) years previous to his death, all of which time was spent in the latter's residence in Honolulu.

In 1902 patient was employed as a nurse in Hilo, Hawaii, and for the next four years he nursed a leper in the Hilo Hospital. He developed the disease himself about at the end of this nursing service, and one year later, i. e., 1907, he entered the Kalihi isolation station. None of his relatives were ever sent into isolation. None of the patient's friends were isolated previous to patient being isolated. Some of his friends have been isolated since he entered isolation himself. He had known persons with whom he went to school that were isolated afterwards, but this, of course, was long ago. When serving as a policeman, he sometimes had to arrest lepers. He never was sick with any disease other than this one, never had itch, and was vaccinated fifty years ago.

CASE 3: The patient is 18 years of age; he developed leprosy two or three years ago. His first symptom was white spots "all over him." At the time he sickened four persons were living with him; they were all well and have remained so. He never lived in the same house with a leper, but his cousin, a leper, lived 300 yards away from him, and the patient often visited him. Patient's grandmother also had leprosy before he developed leprosy; she lived in the same house with

the leper cousin, previously mentioned. The two mentioned relatives have had the disease about six years. His cousin came into isolation with him, but his grandmother was not isolated until last year.

When patient entered isolation he knew no one at Molokai; none of his schoolmates have ever been sent into isolation.

He has had itch, but developed it since he acquired leprosy. He was vaccinated at school nine months before developing the disease.

CASE 4: The patient, a European, is 45 years of age. He first noticed difficulty in breathing through his nose. He had no other symptoms except this difficulty in breathing for a period of five years, when eleven years ago spots came out on his body, the first one appearing on his right leg. He was isolated eight years ago, i. e., three years after the spots appeared. He gives the following history of exposures: He lived with a woman who had just previously lived with a man suffering from leprosy. The woman did not develop leprosy; patient lived with this woman for about a year. It was about three years after patient ceased to live with this woman that the nasal symptom appeared. Patient had also worked for a man in Honolulu who had leprosy and who afterwards died in isolation at Kalihi.

Upon cross-examination, patient states that the man who had previously lived with the woman referred to and who was afterwards isolated, lived for some time in the same house with the patient in Honolulu, and they sometimes ate together.

Patient was vaccinated as a child in Europe and again in 1901, i. e., after he had developed leprosy, but a year before he was isolated.

CASE 5: Patient is 17 years of age; developed leprosy about seven years ago. He remembers that his first symptom was a "little white spot," but he forgot where it appeared. He has never lived with a leper. None of his relatives have leprosy, and the only history of exposure he gives is that while attending school in Honolulu, when he was 8 years of age, there was a boy in the same class with him, who was shortly afterwards sent to Molokai. This boy sat in the same seat with patient, and, to use the patient's words, "had plenty of sores."

Patient has had itch, but not until after developing leprosy. He was vaccinated when he was small.

CASE 6: The patient is only 12 years of age, and, therefore, his history can not be of much value. He does not know how long he has had leprosy. He only knows that his face became red and then white spots appeared on his abdomen and back. Three people were living with him at the time that he sickened, but they have remained healthy. He was isolated three years ago; none of his relatives have ever been lepers that he knows of. The only exposure that he remembers was being taken once to the Kalihi receiving station, pre-

sumably to see some friend of his family, who had been isolated. Nothing more definite in the form of a history could be obtained from this child.

CASE 7: Patient does not know his exact age, probably about 18 years. Developed leprosy when a child. Remembers seeing first spots on his back and legs. As a child he played with a leper. He knows nothing of his parents.

Patient was isolated nine years ago, but he does not remember how long he was sick previous to his isolation. He never attended school. Patient had an uncle sent into isolation before he could remember and, he believes, before he was born. Patient also had a cousin sent to isolation before he came himself. He never saw this cousin until he saw him at Molokai.

Patient had itch when he was about 7 years old and has also suffered from rheumatism. He has never been vaccinated.

CASE 8: Patient is 24 years of age. He developed leprosy eleven years ago. His first symptoms were white spots on his buttocks. At the time that he sickened 14 other persons were living in the house with him, and 3 of these were suffering from leprosy. He was isolated in 1902, i. e., three years after he developed the first symptoms of leprosy.

Patient has a grandfather, uncle, sister, and cousin who have been sent to Molokai with leprosy. He has friends who were sent to Molokai before he was sent, and other friends have been sent over since he was isolated. Some of these persons are former schoolmates of his.

Patient had itch when he was 11 years old, two years before he developed leprosy. He was vaccinated when 14 years old, i. e., about the time or after his first symptoms developed.

CASE 9: Patient is 18 years of age. He developed leprosy seven years ago, the first symptoms he noticed being light-red spots in his face. At the time he sickened six other people were living in the house with him. They were healthy and have remained so. He never attended school with a person whom he knew at that time to have leprosy, but from the boarding school he attended one boy was sent into isolation at the same time that the patient was, and another boy from the same institution was sent into isolation after the patient was isolated.

Patient entered isolation three years ago, i. e., four years after developing the disease. He has been vaccinated three times, had itch after he entered isolation, but never before he developed leprosy.

CASE 10: Patient is 20 years of age, of European parentage, and lived among good surroundings. He developed leprosy last year and was isolated three months afterwards. The first symptoms he noticed were red spots in his face and numbness of hands.

He never saw a case of leprosy until he developed it himself. He had an uncle who was sent into isolation before the patient was born. Fifteen years before developing the disease the patient played with a boy who afterwards died at Molokai of leprosy. With the exception of the uncle and the boy mentioned, no friend or relative of the patient was known to have leprosy before patient himself developed it, nor have any of his friends or relatives been isolated since the patient entered isolation. Patient sometimes went on fishing expeditions and during these spent nights in the houses of Hawaiians.

CASE 11: Patient is 69 years of age, and developed leprosy two years ago, entering isolation a few months later. The first symptoms that he noticed were "spots on his body," swelling of left ear, and numbness in hands. Patient has seen several lepers, but only casually in the streets of Honolulu; knows of no intimate exposure, but his duties were such as to bring him in daily contact with many Hawaiians. He never had any serious illness up to the time he developed this trouble.

Patient never had itch; was vaccinated in 1880. None of his friends or relatives have leprosy.

CASE 12: Patient is 32 years of age. He developed leprosy five years ago; entered isolation two years ago. The first symptoms he noticed were a few spots on his back.

None of patient's friends or relatives have ever had leprosy. He never lived with a leper. He has seen lepers on the Island of Hawaii, but did not recognize the disease at that time. Some of his casual acquaintances have since been sent to Molokai, but no history of intimate exposure could be obtained.

Patient never had itch; was vaccinated when a child.

Case 13: Patient is 50 years of age; a well-developed case; states she does not know how long she has had leprosy. She was isolated eight months ago. Up to about the time she sickened she was engaged in the manufacture of poi.

Patient was vaccinated fifteen years ago; never had itch. The patient, before illness, resided in a small village on the island of Molokai, some distance removed from the leper settlement on the same island, and a district that has furnished a considerable number of cases of leprosy.

CASE 14: Patient is 20 years of age. She always lived in Honolulu. The first symptom she noticed were red spots "all over her body." Patient claims to have had the disease eleven months, but in this matter she evidently desires to avoid our knowing the facts. She was isolated nine months ago. Her sister died of leprosy in isolation nineteen years ago. Her grandmother and uncle had been sent to Molokai with leprosy. The patient "stayed sometimes at houses where lepers lived," and "knew lepers in the country, but all are now

on Molokai;" she also adds that she played with lepers when a child. She did not go to school with a leper that she knows of. Patient's answers regarding lepers she has known are guarded, probably due to the fear that such information might lead to the apprehension of some of her friends, now at large.

Patient has had itch; was vaccinated while at school.

Case 15: The patient is 17 years of age, has had leprosy for seven years, and was isolated three months ago. Two boys with whom he went to school and often played with were sent into isolation before he was. He has "seen people taken to Kalihi with leprosy." He has always lived with his parents in Honolulu. None of his relatives have leprosy.

Patient had itch several times before developing leprosy, and was vaccinated when he was 6 years of age.

Case 16: Patient is 16 years of age, states he became sick three months ago. The first symptom he noticed was the appearance of macules on the face. One of his sisters developed leprosy some years ago and died of it. Patient played with this sister while she was suffering from the disease. Patient has attended a certain Honolulu school; while there one of his schoolmates was sent to Molokai. Besides this sister and schoolmate, patient has seen "several" other lepers at the school he attended. He was vaccinated when small. Never had itch or any illness before developing leprosy.

Case 17: Patient, 14 years of age, developed leprosy eight months ago; first lesions being macules on both legs, posterior aspect.

Patient's brother developed leprosy some time ago and patient played with him while latter was suffering from the disease. Patient's sister is also a leper, developing the disease ten months before the patient did; sister now at the Kalihi receiving station. Patient also has three cousins that are lepers.

She states further that some of her friends have developed the disease and are now also at the Kalihi receiving station. She lived in Kauai and attended school there, but never saw a leper at the school she attended. Has never had any illness previous to developing leprosy. Has never been vaccinated.

Case 18: Patient is 14 years of age, has had leprosy two years. Disease began with macules on legs, just above ankles. Patient only knows of one exposure—and that with some doubt—a girl lived near her in Honolulu that patient thinks was suffering from leprosy. She played with this suspect up to three years ago. All of patient's family are well and she never saw a leper among her schoolmates. Patient has never had itch. She was vaccinated four years ago.

Case 19: Patient is 12 years of age; both he and his brother developed leprosy at the same time, i. e., six months ago. First symptom patient noticed was a macule on left cheek.

He does not know when, if ever, he was exposed to the disease; none of his family have ever suffered from it, that he is aware of. He attended school in Honolulu; none of his schoolmates nor his friends have developed the disease as far as he knows.

Patient has never had itch; he was vaccinated six years ago.

CASE 20: Patient is 17 years of age and sister of "case 17." Developed leprosy eighteen months ago. First symptom noticed was a "cold," followed by nodular lesions of left arm. Otherwise her history agrees perfectly with the history given by her sister.

CASE 21: Patient is 18 years of age; has had leprosy for three years, the first symptom appearing on the left foot. Patient has one brother and one sister who also developed leprosy some years ago, the former having died of leprosy at Molokai. Also one of the patient's friends developed leprosy some time before the patient himself did.

With the exception of these cases, the patient's statements are somewhat vague.

SUMMARY.

From the data gained in these few histories, the following points are worthy of notice:

First. A large percentage of the cases give a history of exposure to leprosy some time before they themselves developed the disease. Usually such exposures were of an intimate character.

Second. While itch was a common disease among these cases, there appears to be no definite evidence that a connection existed between the occurrence of itch in some of these patients and the subsequent development of leprosy.

Third. There is nothing in these histories to indicate any relationship between vaccination and the spread of leprosy.

A CONTRIBUTION TO THE STUDY OF RAT LEPROSY.

By Donald H. Currie, *Passed Assistant Surgeon and Director, Leprosy Investigation Station*, and Harry T. Hollmann, *Acting Assistant Surgeon, Leprosy Investigation Station, Public Health and Marine-Hospital Service.*

INTRODUCTION.

The close resemblance between the lesions of rat lepra and of human lepra are well known, and for this reason any new observations that are made in the case of the animal disease are also of interest, and possible service, in the study of the analogous human affection.

With this idea before us, we requested Passed Assistant Surgeon McCoy, United States Public Health and Marine-Hospital Service, stationed in San Francisco, to procure for us twelve white rats (*Mus albus*), inoculate them with rat lepra, and forward them to this station. Twelve of these animals were inoculated by him in December, 1909, and reached us several weeks later.

These animals apparently remained in good health from the day of their inoculation (December 7, 1909) up to May, 1910, when several sickened and later died with the lesions to be subsequently described.

Before presenting these observations, however, we shall review the literature of rat leprosy.

LITERATURE BEARING ON RAT LEPROSY.

Stefansky (*a*) made the first recorded observations on this affection. He recognized two forms of the disease, one the "purely glandular" and the other the "skin muscular" ("Hautmuskulär"). The former was the more frequent in his experience.

In the glandular form he met with cases in which one gland alone was affected, the rest of the body being presumably healthy, and in such cases it was generally an axillary gland that was involved.

Stefansky describes the "skin muscular" form in nine cases. From the description it appears that his cases were all far advanced, as large areas were involved, not only of the skin, but also the underlying muscles to a depth of one centimeter. He inoculated other animals without results. These failures apparently were due to not waiting sufficiently long for the results. In one case he noted a collection of pus-like material following intraperitoneal injection.

Rabinovitch (b) became familiar with the disease in Odessa from observing the work of Stefansky. She returned to Berlin and searched for the disease among the rats there. She describes two such infected animals. In each she noticed what appears to be an earlier stage of the disease than that seen by Stefansky in Odessa. But the disease was sufficiently advanced, even in Rabinovitch's case, to show numerous scattered lesions of the skin, with some involvement of the lymphatic glands. At the time of writing, i. e., five weeks after the inoculation of her animals, the latter had failed to develop the disease.

Dean (c) observed a rat suffering from this disease 11 miles outside of London. The case was apparently well advanced, both skin and muscular tissue being involved over a considerable area. At the time of writing, i. e., fifty-six days after the inoculation of his animals (2 white rats) he had failed to reproduce the disease.

The same author (d) states that since writing in 1903 he has observed six more examples of the disease, as it naturally occurs in rats, and also that, since writing his first article, he has succeeded in obtaining a number of positive inoculation results in rats.

Dean believes that there is no very strict line of demarkation between the two types, as described by Stefansky. Dean describes the disease as met with in well-developed cases and also mentions rarer types of late cases, which showed involvement of the liver and lungs. He has found the specific bacilli twice in the nasal secretions, and he has noted mutilations, such as loss of toes and tails.

Dean inoculated 30 rats with the material obtained from his leper rats. In 9 of these 30 rats he was successful in reproducing the disease; in 3 cases he was able to reproduce the disease to the third generation. Death of the inoculated animals occurred from six to twelve months after inoculation.

* * * Subcutaneous inoculation was in several instances followed by the production of a local lesion, but this was not a constant result. The lesion consisted of a nodule, containing a semicaseous-like substance, resembling the material which was present in the skin infiltration of naturally infected animals. The acid-fast bacilli were very numerous in these local lesions. The lymphatic glands in such cases, even at a distance from the lesion, were sometimes invaded by the bacilli and showed the changes already described.

Several of Dean's rats died of what he believed to be "intercurrent affections," the nature of which he does not state.

Tidswell (e) noted the disease in a single animal, captured in Sydney in 1904. Its skin was abundantly studded with nodules; the neighboring glands were not involved.

The "Reports on Plague Investigations in India," issued by the advisory committee appointed by the secretary of state for India, etc., and usually referred to as the "English Plague Commission to

India," (*f*) contain the following note, which is given in full: "It is perhaps worth recording that the leprosy-like disease of rats, due to acid-fast bacilli, described by Stefansky (Centralbl. f. Bakt., vol. 33, 1903, p. 481) and Dean (this Journal, vol. 5, p. 99) has been met with in *Mus decumanus* in Bombay and in *Mus rattus* in the Punjab."

Bull (*g*) has written on this subject, but the original of this article is not accessible to us and neither of the two publications, quoted as referring to it have abstracted the article. His observations are therefore, unfortunately, unknown to us.

Wherry (*h*) wrote an article from his experience with two rats that were suffering from the disease. The animals presented general subcutaneous congestion, congestion and hypertrophy of the cutaneous, axillary and inguinal glands, numerous minute yellowish tubercles in the subcutis and irregular nodular thickening of the skin. Before his article went into press the author adds two more cases of the disease which, however, like the previous ones, were rather far advanced. At the time of writing, i. e., two months after the observation, the two white rats inoculated had not developed the disease. This investigator examined a flea caught from one of the infected animals, but found no acid-fast bacilli in the insect.

The same author (*i*) later shows that certain flies (*Calliphora vomitoria*, *Lucilia Caesar*, *Musca domestica*) will imbibe and discharge the rat lepra bacilli. The only portion of this latter article that bears upon the subject with which we are now dealing are the results of his examination of ecto-parasites of leprous rats. He examined one specimen of *Ceratophillus fasciatus*, one specimen of *Ctenopsyllus musculi*, one rat louse (*Hæmatopinus acanthopus*), and one cone-nosed arachnidian, but found no acid-fast bacilli in these parasites. In the same paragraph the author states:

The character of the early lesion present in naturally acquired cases of this disease seems to point to inoculation through the skin.

It is evident from this that the earliest cases observed by this author showed involvement of the skin.

In 1909 the same author (*k*) states:

A leper rat (*Mus norvegicus*, male) in a very advanced stage of the disease was seen to be literally covered with louse eggs. Only a few lice could be fonnd. Six of them (*Hæmatopinus spinulosis*) were ground np on a slide and stained for lepra bacilli. Several hundred acid-proof bacilli resembling the bacillus of rat leprosy were found scattered about in what appeared to be the granular contents of the intestinal tract.

These examinations were made in April, 1909, and are the only ones made on rat lice taken from leper rats since the publication of a previous note. A number of lice from normal rats were examined for acid-proof bacilli, with negative results.

McCoy (*l*) states:

The essential lesion, or at least the one invariably found, has been a more or less general infiltration of the subcutaneous tissues, and the peripheral lymph glands, with an enormous number of fine white or slightly yellowish granules. At times this infiltration forms a general layer covering the whole surface of the body between the skin and muscular tissues. At other times it is more or less patchy in distribution.

He then mentions the glandular involvement, alopecia and ulcerations. Once he met with visceral rat leprosy in an advanced case. At the time of writing he had made a number of inoculations, but sufficient time has not elapsed to show any results from these experiments.

The same author (*m*) again writes from the experience of 8 rats. The article deals with the epidemiology of the disease. The subjects of parasites or early lesions, with which we are now dealing, are not covered.

The editor of the Lancet (*n*) mentions the presence of rat leprosy in San Francisco.

Mezinescu (*o*) describes late cases of rat leprosy observed by him, the animals showing ulcerations of the skin, etc.; rarely he met with visceral lesions.

Walker (*p*) speaks from her experiences with 14 rats which had naturally acquired rat leprosy, and states:

Of the 14 positive cases all showed alopecia more or less marked in degree—sometimes confined to some one region * * *.

In only 1 case out of the 14 were the glands involved; none showed visceral lesions. Of the 3 animals of which she publishes the necropsy notes 1 appears to have shown rather localized lesions of skin and in 2 the involvement of the skin was quite general. No mention is made of parasites in relation to the disease.

Kitasato (*q*) found four leprous rats in Tokyo. He mentions the alopecia, skin and subcutaneous tissue lesions, and involvement of the glands. The subject of early lesions and insects is not considered.

Brinckerhoff (*r*) after reviewing the literature, records below-mentioned lesions, which he has observed in the experimental disease (the naturally acquired disease never having been noted in the Hawaiian Islands): Slight enlargement of the peripheral lymph nodes, which contained the bacilli; microscopic lesions of the liver containing the bacilli, the negative results from the examinations of the nasal secretions.

To the above literature we desire to add the personal communication from McCoy, informing us that in San Francisco a large percentage of the leprous rats were afflicted with scabies.

In the later months of 1908 the former director of this station, Dr. W. R. Brinckerhoff, had secured some rats from San Francisco that had been artificially inoculated with rat lepra and which later died of this disease. After we had made these observations, to be later described, we remembered Brinckerhoff's previous work and looked up his records. From these we chose the following necropsy notes as having an interesting bearing on the subject. The following are these notes in full; they have not been previously published as such, although the article referred to above under his name (Brinckerhoff) was probably in part based on these autopsies:

UNPUBLISHED NOTES OF BRINCKERHOFF ON WORK WITH RAT LEPROSY.

I.

Rat found dead. Male. Autopsy: Some odor of decomposition. In lower abdomen a tumor mass, 3 by 2 by 2 centimeters, which is a cyst with a wall 2 or 3 millimeters thick, and filled with a yellowish green caseous material. Other abdominal organs appear normal. Lungs hyperæmic and lower right lung shows white nodules, 2 millimeters in extent, which on section contains creamy pus. Smears from material from abdominal tumor shows large number of bacilli with the morphology and staining reaction of bacilius lepræ. Smears from nares negative.

II.

Rat. Full-grown male. Presents open ulcer on abdomen about its center, 2 by 1½ centimeters in extent, with slightly elevated edge. Near center is white nodule, 4 millimeters in extent, forming slight elevation 2 millimeters high on base of ulcer. Base of ulcer smooth, edges smooth and not overhung. Pale white to yellow color. On dissection nodule described incised and smear shows numerous acid-fast bacilli; left axillary lymph node slightly enlarged, 5 millimeters in extent; other peripheral lymph glands not notably enlarged. Internal organs appear normal, smear from spleen negative. Left axillary lymph node and bit of tubercle in base of ulcer ground in sterile mortar with sterile salt solution. Smear of suspension shows many acid-fast bacilli.

III.

Large white rat; hair sparse all over body, no definite areas of alopecia, many fleas. Chloroformed, fleas collected and smears made by crushing abdomens (of insects) * * * smears from fleas negative. Axillary glands and inguinal lymph glands appear normal. Abdominal organs appear normal in the gross. Smears from spleen pulp show moderate number of acid-fast bacilli, usually single, some slender, some about the size of a tubercle bacillus. On opening the thorax, the only lung tissues remaining is the left upper lobe, which appears approximately normal. Both lobes of the right lung and the left lower lobe have been converted into abscess cavities, each approximately 1 to 1½ centimeters in extent. On incising these cavities, the contents is a rather dry granular caseous material of grayish color. The caseous material is readily removed from the tumor, leaving a definite thin wall, about 2 millimeters in thickness, with a smooth inner surface. Heart not notable. Smear made from caseous material shows no bacteria.

IV.

This rat appears to have died in the early stage of the disease; necropsy showed a "tumor" of the skin. The following are taken from the necropsy notes:

"Section (of 'tumor') shows a part of the central caseous mass and the wall of the tumor. No definite limiting membrane can be made out. The central mass consists of granular débris, containing masses of slender bacilli, interspersed with small irregular blue staining masses (nuclei débris), and amorphous granular material (necrotic tissue). The bacilli took the Eosin stain; they are distinctly beaded. As one passes from the necrotic central mass outward the tissue elements become distinguishable as elongated cells with oblong or oval vesicular nuclei lying among wide bands of connective tissue substances. The protoplasm of these cells are crammed full of slender, beaded bacilli. Occasional islands of plasma cells are found. From there outward the tissue seems to be composed of large areas of cells with distorted vesicular nuclei whose protoplasm is filled with the bacilli, the cell groups being marked off by bands of relatively normal connective tissue bearing small blood vessels. In this region the picture is strikingly like a human leproma. The bacilli which take the Eosin are also alcohol and acid fast. Lung: In one area the alveoli are filled with coagulated serum, elsewhere are large and small foci in which the bronchi and adjacent alveoli are filled with polynuclear leucocytes. Lung stained with carbo-fuchsin shows no acid-fast bacilli. Process seems to be acute purulent bronchitis with peribronchial pneumonia. Probable cause of death?"

SUMMARY OF THE REVIEW OF LITERATURE OF RAT LEPROSY.

It will be seen from the above abstracts that other observers have noted pulmonary lesions in rat lepra, but they either passed them over without recording any conclusions as to their significance or they considered these pulmonary lesions to be a late lesion of the disease, secondary to the involvement of skin and lymph nodes.

We also see that in the few recorded examinations of the ectoparasites of the leprous rats, previous investigators have failed to discover the rat lepra bacillus in these parasites' bodies, except in the case of Wherry (*k*) who found them in the bodies of the six lice he examined.

INVESTIGATIONS OF WRITERS OF THIS ARTICLE.

The following are the notes recorded by the writers of this article on several cases of rat leprosy that have recently been inoculated by McCoy in San Francisco, in December, 1909, and sent to this station.

It will be observed that we failed in the case of the first few rats to recognize the fact that the pneumonia present was due to the bacillus of rat leprosy, but considered the pneumonia as an accidental lesion.

RAT I.

A full grown white rat which had been inoculated with rat lepra by Passed Assistant Surgeon McCoy in San Francisco on December 7, 1909, was found dead in its cage on May 3, 1910.

The following are the autopsy findings:

Skin normal; shows neither thickening nor ulceration. Alopecia not present. Animal in state of good nutrition. All organs macroscopically normal, except the lungs, both of which show areas of broncho-pneumonia scattered throughout their lobes. A smear was made from the cut surface of the organ and stained for acid-fast bacilli. A short search was made (at that time we did not connect the pulmonary lesion with rat leprosy). It showed no acid-fast bacilli. Cocci, occurring in pairs, were found scattered through the fields, very few in number, but as no other organism was found it was presumed that these were the cause of the animal's pneumonia.

Comment.—From our experience in the rats that died afterwards it is probable that a few acid-fast bacilli would have been found had the search for them been long enough, but inasmuch as we did not think of pneumonia as an *early* lesion of rat leprosy we were satisfied when we found the diplo-coccus and searched no further. During the autopsy a number of mites (*Laelaps echidninus*)[a] were collected, smeared on microscopical slides, and fixed ready for staining. When we failed to find any evidence (that we then recognized) of rat leprosy, the smears from these parasites were unfortunately destroyed without examination. It is interesting to note, however, the fact that these parasites were present in immense numbers on this rodent.

RAT II.

Autopsy.—Animal in good condition; no alopecia observable; abdomen shaven to obtain a better view of the skin. In the medium line, just below a point half way between the sternum and the pubis, is a white V-shaped scar, with its apex pointing toward the pubis, certainly the result of a wound, and probably the point at which the animal was inoculated. Extending from this point toward the pubis is an area of infiltration of the skin, irregular in shape and covering about one-half of a square inch. The area extends toward, but not to the inguinal glands on both sides. The skin covering this area appears to be thickened, but upon closer examination it is found that this is due to infiltration of the subcutaneous tissues, and that the skin when dissected loose shows irregularly scattered areas of atrophic thinning. The subcutaneous tissue at first sight appears like fat and is filled with small white granules; the abdominal muscles lying underneath this area are normal; the inguinal and axillary glands are not involved. The visceræ are normal, except the lungs, which show a double broncho-pneumonia. Smears made from the lungs show a Gram-staining diplo-coccus in small numbers; another smear from the lung is stained for bacilli lepræ, but an examination of short duration fails to show acid-fast organisms.

The area of infiltrated skin and subcutaneous tissues show large numbers of slim, acid-fast bacilli, very similar to the human lepra bacillus in morphological and tinctorial peculiarities. The inguinal glands show no bacteria of any kind.

The body surface of the animal was found to contain 54 mites (*Laelaps echidninus*). Seventeen of these were killed, mashed, smeared on glass slides, stained with carbo-fuchsin (Nielson), decolorized with 1 per cent nitric acid in 70 per cent alcohol for ten seconds, counterstained with Loeffler's alkaline-methylene blue, and examined under the oil-immersion lens. Of these 17 mites, 4 showed typical rat-lepra bacilli in considerable numbers, these bacilli differing

[a] We desire to acknowledge the aid furnished us by Messrs. Nathan Banks and David T. Fullaway, United States Department of Agriculture, who kindly identified this parasite for us.

in no respect from those contained in the tissues above described, even to the occurrence of the characteristic clumps. Thirty-two of these parasites were placed on three specimens of rats (*Mus alexandrinus*), no uninoculated white rats being available for this purpose.

One hundred house flies were fed with the leprous infiltrated subcutaneous tissue, placed in a cage with two other roof rats (*Mus alexandrinus*) whose tails had been abraded by scraping, so as to make them attractive to the flies and also to afford a lesion for the possible entrance of the bacilli.[a]

The remaining 5 ecto-parasites were reserved for species diagnosis.

We excised several pieces of lung tissue and placed them on glycerin agar slants. These latter were incubated at 35° C. to 37° C.

Rat III.

Autopsy notes.—Skin and subcutaneous tissues perfectly normal. All viscera normal, except lungs, which show the same broncho-pneumonia noted in the first two animals. Examination of these lungs showed a few diplo-cocci, after long search, hardly sufficient to consider them infecting agents, but no other bacteria were demonstrable by the ordinary anilin stain, and a short search after the staining for acid-fast bacilli with carbo-fuchsin, acid alcohol, alkaline-methylene blue, counter stain, showed no acid-fast bacilli. Autopsy was closed without satisfactory explanation having been obtained as to the cause of the animal's death.

Rat IV.

Found dead on May 10. Autopsy shows neither ulceration of skin nor alopecia. The skin, subcutaneous tissues, superficial muscles, and lymph nodes normal.

All viscera normal, except the lungs, which showed a broncho-pneumonia with small abscesses scattered throughout the pneumonic areas.

Four mites (*Laelaps echidninus*) were captured from the body of this animal. These parasites were crushed and smeared and these preparations stained for acid-fast bacilli.

The lungs were placed in sterile dishes for further examination; the other organs of the animal appearing normal, the animal (except its lungs) was destroyed. A few hours later the lungs were incised through under aseptic precautions, a number of smears made from them and stained for acid-fast bacilli. Careful and prolonged examination of these smears were made with the result that an immense number of acid-fast bacilli were observed, these bacilli, however, were not evenly distributed through the lung substance, long search often failed to show any in some of the smears, but when found at all, they were present in clumps containing great numbers. They were slim, acid-fast rods, occurring singly and in clumps, and were in every way typical of the bacillus of rat leprosy.

We then examined the smears from the four mites. Two of these parasites showed typical rat lepra bacilli in considerable numbers. Two showed no lepra bacilli. In the previous rat (Rat II), when we found the bacilli in these parasites, we supposed they had imbibed them by feeding over the skin lesion of that rodent. But this rodent (Rat IV) had no skin lesion, so the presence of the lepra bacilli in these mites would appear to indicate that a septicemia existed. As the body of the rat had been destroyed, we could not confirm this. After finding the acid-fast bacilli in the lung of this rat, we returned to Rat II and

[a] The results of these attempts to inoculate will be reported on later.

removed a small portion of the lung tissues of that animal, that we had placed on the glycerin-agar tubes (*vide supra*). Examination of this lung tissue showed an immense number (it was estimated an average of 2,000 to 3,000 lepra bacilli per oil immersion field) of typical lepra bacilli; every field being crowded with them. Considering the negative results of the first examination of these tissues when fresh, it was not possible to believe otherwise than that these bacilli had greatly multiplied in the dead lung tissues. No growth, however, had occurred on the surface of the glycerin-agar slants, upon which these bits of tissue had rested. An occasional nonacid-fast coccus was also found, but very few in comparison to the acid-fast bacilli.

From the lungs of Rat IV we inoculated all ordinary laboratory media, including glycerin-agar and glycerin-glucose-agar slants and placed them at 37° C. From these same lungs, containing the acid-fast bacilli, we prepared a heavy suspension and injected 1 cc. of this into the peritoneal cavity of a suckling guinea pig.

From the lung tissue of Rat II that had laid on the glycerin-agar slants and in which so many lepra bacilli were found, we prepared a suspension and injected 1 cc. of it into the peritoneum of another suckling guinea pig.

Rat V.

Autopsy and notes.—After the experience above noted, we chose one of these rats, which had been inoculated with rat leprosy on December 7, 1909, and which appeared to be in perfect health. This animal was chloroformed and a complete necropsy performed, the notes of which appear below:

Careful inspection revealed no lesion of the skin, alopecia, etc. The animal was skinned, but neither skin nor subcutaneous tissues showed any pathological changes of any organs, except a double broncho-pneumonia, involving over one-half of the total lung tissue. Small portions of these consolidated lobes were excised and smeared on a slide, after which they were stained in the usual manner or lepra bacillia. Examination of these smears showed from 3 to 200 acid-fast bacilli per field, these organisms were identical in appearance to the bacillus of rat leprosy.

Smears were made from the heart blood, stained and examined, and a few lepra bacilli were found. Two cultures were taken from the heart blood on glycerin-glucose agar. Another smear was made from the heart blood, fixed with wood alcohol and stained in the usual manner. It showed a moderate number of acid-fast bacilli, varying from one bacillus in ten fields to three bacilli in a single field.

The spleen presented nothing abnormal. It was cut through the central portion under aseptic precautions and a smear made from the splenic pulp, stained, and examined. Examination of this smear showed a few (an average of one organism to three fields) acid-fast bacilli, morphologically identical to the other bacilli noted.

The liver was next examined under aseptic precautions and showed macroscopically no changes. A smear was made from it and stained in the usual manner. Rather prolonged search failed to show any lepra bacilli.

Examination of 11 mites (*Lælaps eschidninus*) showed 6 containing lepra bacilli and 5 not containing lepra bacilli. The examination of 1 louse (not classified) showed 2 lepra bacilli.

Four guinea pigs and two rabbits were inoculated with a suspension of the consolidated portion of the lung.

An uninoculated specimen of *Mus alexandrinus* was chosen and its lungs removed, which, as would be expected, were perfectly normal. It was cut up into small pieces and placed in a Petri dish, after which purulent matter from

the lung of Rat V was picked up with a platinum loop and smeared over this bit of lung tissue; in other words, the cut surface of the healthy rat's lung was used as a culture media. The bottom of this Petri dish, containing these inoculated specimens, was moistened with ordinary bouillon to prevent its drying out. Ordinary laboratory media, including glycerin-agar, were also inoculated with the purulent matter of the lung, a portion of the spleen, and heart blood. Some cultures were incubated under aerobic and some under anaerobic conditions.

ILLNESS OF ALL REMAINING RATS.

Soon after this necropsy, in the latter part of May, all of the remaining rats became ill, the most notable symptom being rapidity of respiration and stupor. On June 2 all of the remaining animals (seven) had greatly improved or recovered from this dyspnœa except two.

One of these animals was still very ill on July 11, although its dyspnœa was less marked than at the onset. A description of this animal's condition is given under "Rat VII." The other one of these two very sick animals died on June 13. The following are the necropsy notes on this latter animal:

RAT VI.

Animal sickened in May and became much worse about June 7, with very rapid respiration. It continued in this condition until June 13, when it died. At the time the animal was brought into the morgue its body was found to be swarming with the same kind of mites (*Lælaps echidninus*) noticed in the other animals.

Of these parasites, 34 were captured, their bodies smeared on glass slides, stained with carbo-fuchsin, and examined. All of these 34 parasites showed acid-fast bacilli in at least one-half of the microscopical fields examined. In those fields where bacilli were found in greatest numbers a count was made, which showed the following numbers of bacilli present per field: One field showed 5 bacilli, another field 10, another 17, another 20, another 50, and one showed a clump of over 300 acid-fast bacilli. On the other hand, from 1 to 3 bacilli were the common numbers met with.

Animal was stretched, skin inspected, alopecia and thinning of the skin present over the lower portion of the animal's abdomen. A brawny, fat-like layer is encountered underneath the skin, the examination of which shows myriads of acid-fast bacilli. There is no involvement of the inguinal glands. The same fatty-looking material is encountered around the axillary region, and the right axillary gland is slightly enlarged. It is excised for examination and shows an immense number of acid-fast bacilli. The left axillary gland shows a similar slight degree of enlargement.

The abdominal cavity is opened. The omentum is excessively rich in fat, the spleen is incased in a "sugar-coated" capsule, due to a chronic perisplenitis. The kidneys are surrounded by fat; they are excised for examination.

The thorax is next opened. The organs lie in about normal position. The heart cavity is opened after burning the surface of the organ, and a drop of blood taken, smeared on a slide, fixed, stained for acid-fast bacilli. Lungs are removed. Right lung does not collapse completely; most of the organ is of a light pinkish color, especially the lower lobe, with ivory-white spots scattered over its surface. The upper portion of the lung is dark red in color, except for the white spots mentioned. This portion does not contain the pinkish colored areas seen in the lower lobe. The dark portion of the lung collapses more completely. It is softer to the forceps' touch, the lower being more firm. The left lung is of a uniformly dark-red color, but collapses almost completely.

Incision is made into the right lung, lower lobe. Its cut surface presents a white-colored area, showing consolidation. Pressure on this white area causes a cheesy-like mass to exude. Smears made from this cheesy mass, stained with carbo-fuchsin, and examined. Incision through white spots shows that they represent abscesses filled with cheesy matter.

A portion of the spleen is next removed and is found to be incased in a much-thickened capsule, which has a granular white appearance, but is not suggestive of tuberculosis. A smear is made from this spleenic capsule and from the spleenic pulp and examined. Cultures are made from spleen and lung on ordinary media, including glycerin agar.

The omentum is greatly enlarged, fills and distends the peritoneal cavity; a smear is made from it and stained for acid-fast bacilli. This enlargement is due to a fat-like substance, which closely resembles the description given by previous observers of the rat leprous infiltration.

Examination of smears: Smears made from the infiltrated subcutaneous tissues, the heart blood, the lungs, spleen, omentum, all show acid-fast bacilli. The smears from the infiltrated subcutaneous tissues, lungs, spleen, and omentum show *immense* numbers of the bacilli, while the heart blood shows fewer bacilli. The lungs of this animal appear to have been infected for a longer period than the lungs of the other animals examined, and it was believed at the time of necropsy that the appearance of these organs suggested that resolution was taking place in the pneumonic areas and that had the animal lived longer only the small areas of focal necrosis (abscesses) would have remained; but of this we could not, of course, be absolutely certain.

Two guinea pigs, each 6 weeks of age, were inoculated intraperitoneally with 1 cc. each of a heavy suspension of the rubbed-up lung tissue and the infiltrated subcutaneous tissues, these suspensions being very rich in acid-fast bacilli.

Rat VII.

On June 2, among the remaining inoculated white rats, one was noticed to be suffering very severely from dyspnœa, the animal's respiration being two or three times as rapid as normal. From the appearance of the animal we expected it to die in a few days. Inspection made at this time showed no alopecia, ulceration of the skin, nor nodule deposit. The animal was separated from the others and observed. After several days the animal appeared somewhat improved. It frequently came out of its nest to take food, although it seemed to be very weak. The hair of the animal remained normal up to very recently.

Inspection on July 11 shows the following: The animal's respiration is still rapid, but not nearly as rapid as the time it first sickened. It is barely able to crawl around its cage to procure food. Two areas of alopecia have appeared upon its back, the hair is roughed up, but no ulcers are noted. One of the notable features in this animal, as well as in the ones previously autopsied, is the presence of numerous mites (*Laelaps echidninus*), the hair simply being a swarming mass of these parasites, and on the head alone it is not unusual to see 12 or 15 at one time. No lice or fleas were observed on inspection. The animal is being held for further observations.

July 12: Inspection of the remaining five inoculated rats (not including Rat VII) made to-day. Loss of weight, alopecia, and great weakness are noticeable symptoms in several of them. No dyspnœa is noted, although these animals suffered from that symptom in the latter part of last May.

Necropsy notes on rat VII.—Animal has since the last notes been resting quieter and appears to have almost recovered from the dyspnœa, with which it had been suffering for several weeks past, but on the other hand the animal has lost considerable weight. It died on the night of August 9, and was

autopsied about 10.30 a. m. the following day. Body very much emaciated; no alopecia present, except the areas mentioned in its clinical history, and one a little larger than the size of a pea, over the abdominal surface. This latter may represent the place of inoculation.

With the exception of these, the skin, subcutaneous tissues, and all the superficial glands are normal.

Abdomen opened. All the abdominal viscera are macroscopically normal.

Thoracic cavity opened. Left lung pale in color. Does not completely collapse, but extends over to the right side of the cavity for a distance of fully 1½ centimeters. This left lung is removed. A number of incisions are made into organ. The larger bronchi and connecting cavities are filled with a cheesy mass, which forms castlike plugs. With the exception of the cheesy matter filling the bronchi and an emphysema, there is nothing abnormal about the organ. No nodules are noted.

Right lung. Organ dark red in color. It is excised. Incision shows numerous hard areas scattered throughout the organ. These areas are found to be filled with the same cheesy matter which fills the distended bronchi and abscesslike cavities of its fellows.

RESULTS OF INOCULATION OF ANIMALS.

All of the animals inoculated from these rats apparently remained in good health. On July 11 they were all chloroformed (from the twenty-eighth to the fifty-fifth day after inoculation). The following are the necropsy notes on these inoculated animals:

ANIMALS INOCULATED FROM RAT V.

The two rabbits and four guinea pigs, inoculated from the lung of rat V, on May 16, 1910, were chloroformed on July 11. These animals have apparently remained perfectly healthy since the day of inoculation; their appetites have been normal and there has been no appreciable loss of weight.

First rabbit.—Large brown rabbit. Autopsy shows a perfectly normal, well-nourished animal.

Second rabbit.—Large white rabbit. Nutrition normal. All organs normal.

First guinea pig.—Medium-sized guinea pig, animal well nourished. The animal was inoculated subcutaneously over center of abdomen, lower half. If we were dealing with tubercle, its first tubercular infection should have occurred in the inguinal glands. These glands, however, are found to be perfectly normal, hardly being visible. The axillary glands are also normal. Thorax opened, lungs and pleura found to be normal, except the spleen, which presents, near its surface, three nodules of the size of a pea, of white color; they are very soft on palpation.

These nodules were incised; they cut easily; a very liquid pus exudes from them. Repeated smears were made from them, stained with carbo-fuchsin, decolorized in acid alcohol and counterstained with Loeffler's methylene blue and thoroughly examined. Examination does not show a single acid-fast bacillus in any of the slides made. A few short, plump, blue-staining rods, occurring in pairs, are found, but in such small numbers as to cause us to suspect them to be accidental or post-mortem invaders. The examination is sufficient to show that either the animal has had tuberculosis and has recovered, which is unlikely, or these spleenic abscesses are due to some other undiscovered cause. A thorough search is made for secondary nodules of small size throughout the body, but without discovering any. The nutrition of the animal, as previously mentioned, is exceptionally good.

Second guinea pig.—The animal was inoculated at the same time as the previous one, and from the same rat lung. Nutrition and muscular development excellent. This animal was inoculated subcutaneously, like the other pig. Inguinal glands normal in size, incased in fat.

Thorax opened: Heart, lungs, and pleura normal.

Abdomen opened: Unusual amount of mesenteric fat, but not of a character ordinarily met with in rat leprosy. All organs normal. Smears made from the superficial glands nearest to the site of inoculation, stained in the usual manner for acid-fast, bacilli and examined. No bacteria of any kind noted.

Third guinea pig.—Guinea pig inoculated from the lung of Rat V on May 16 is autopsied. Animal shows unusually good nutrition and muscular development. Inguinal glands heavily incased in fat; glands themselves normal.

Thorax opened: Lungs, heart, and pleura normal.

Abdominal cavity opened: Abdominal fat well preserved. All organs, including spleen, perfectly normal.

Fourth guinea pig.—Guinea pig, inoculated on the same day from lung of Rat V, is autopsied. Muscular development and nutrition well preserved. Inguinal glands heavily incased in fat, very minute in size, and normal in appearance. Axillary glands normal in size and appearance, heavily incased in fat.

Thoracic and abdominal cavities opened: Lungs, heart, and pleura perfectly normal. Abdominal fat well preserved. All abdominal organs normal.

ANIMALS INOCULATED FROM RATS II AND IV.

A suckling guinea pig, about 3 weeks of age, was inoculated with an emulsion, formed by rubbing up a piece of the lung of Rat II. Another animal of the same age was inoculated with an emulsion of Rat IV, which was rich in acid-fast bacilli, believed to be bacilli of rat lepra. Both of these pigs received 1 cc. intraperitoneally of this suspension. This method of inoculation was used in order to rule out the possibility of a strain of tubercle that was weakly infective for guinea pigs, it being believed that these tests alone would suffice, the dose being so heavy and the animals being so young. The two animals were placed into a cage with their mother, which latter was not inoculated.

Autopsy notes on suckling guinea pig No. 1 (inoculated from Rat II).—Animal well nourished and muscular development good. Subcutaneous fat well preserved or a young animal. Inguinal glands barely large enough to be visible and encased in fat.

Thorax and abdominal cavity opened, lungs, heart, and abdominal organs perfectly normal. Peritoneum thoroughly inspected, especially about site of inoculation, and found to be absolutely normal.

Autopsy notes on suckling guinea pig No. 2 (inoculated from Rat II).—Size, nutrition, and muscular development exactly like animal just autopsied. Subcutaneous fat well preserved for animal of this age, encasing normal inguinal and axillary glands.

Thorax and abdominal cavity opened. Lungs and heart normal in appearance. Peritoneum, especially about the site of infection, thoroughly inspected for tubercle deposits. The peritoneum, spleen, and other abdominal organs are perfectly normal. The autopsy on these two animals indicates very positively that the emulsion injected into them did not contain tubercle bacilli.

ANIMALS INOCULATED FROM RAT VII.

Two guinea pigs, about 6 weeks old, were inoculated on June 13 from the lung and subcutaneous tissue infiltration of Rat VI. This material was rubbed up into an emulsion. The emulsion was examined and found to be rich in acid-fast bacilli. Each of these animals received 1 cc. They were autopsied on July 11;

i. e., nearly one month from the day of inoculation. The development and nutrition of one of these animals had never been very good, but possibly this is due to its mother deserting it early, as it sometimes happened with our pigs. It has, however, fed well and appeared in perfect health. The other animal was well developed and well nourished and, like the other pig, has always had a good appetite.

Autopsy notes on the first guinea pig of Rat VI.—This is the animal last described as being the one well developed and well nourished. The inguinal glands are encased in fat and of such size as to be barely visible to the naked eye. A slight scar is present in the anterior abdominal wall, at the site of inoculation. The peritoneal cavity is first opened and inspected for nodules or other evidences of tubercular infection, but without results, the peritoneum throughout being perfectly normal in appearance. The spleen and other abdominal organs are also perfectly normal, the peritoneal fat is well preserved. The scar mentioned was probably due to an injury inflicted by the instrument's insertion. The lungs, pleura, and heart are perfectly normal in appearance.

Autopsy notes on the second guinea pig of Rat VI.—This is the one of poor nutrition, probably due to an accident in rearing. Subcutaneous fat is not well preserved. Has very little fat about inguinal and axillary glands.

Thorax opened: Heart, lung, and pleura normal.

Abdominal cavity opened: All the abdominal organs are perfectly normal.

A smear made from the peritoneum of the first of these two guinea pigs is examined and found to be negative as to acid-fast bacilli.

Rat VIII.

Animal found dead in its cage about 5 p. m., July 16. Autopsy was begun on it about two hours later. This animal is one of the rats that sickened in May, when it was noticed to be suffering from rapid respiration, similar to, but milder than the symptoms of the rats which have previously succumbed.

Inspection of the body showed an immense number of mites (*Lælaps echidninus*) crawling over it. These parasites were chloroformed, collected, and counted, and it was found that there were 352 of these mites on the animal's body. Forty-eight of these parasites were chosen, their bodies smeared on glass slides, and examined, with the following results:

Forty-eight mites were examined, 30 fields being examined in each mite.

Three mites showed an average of 2 acid-fast bacilli per mite.

Seven mites showed an average of 6 acid-fast bacilli per mite.

Seven mites showed an average of 8 acid-fast bacilli per mite.

One mite showed 10 acid-fast bacilli.

Four mites showed an average of 2 acid-fast bacilli per oil-immersion field.

Six mites showed an average of 3 acid-fast bacilli per oil-immersion field.

Two mites showed an average of 6 acid-fast bacilli per oil-immersion field.

One mite showed an average of 10 acid-fast bacilli per oil-immersion field.

Two mites showed an average of 20 acid-fast bacilli per oil-immersion field.

One mite showed an average of 50 acid-fast bacilli per oil-immersion field.

Fourteen mites showed no acid-fast bacilli.

Inspection of the animal's body shows the animal to be greatly emaciated. Over its back several areas of alopecia, varying in size from 1 to 1½ centimeters in diameter, roughly circular in shape, are noted. The lower two-thirds of the abdominal surface shows alopecia. This area is only broken by small scattered patches of hair. Two ulcers are noted on the abdomen of the animal, the larger of which is three-quarters of a centimeter in diameter, scooped out, edges sharp, not undermined, and base formed by the subcutaneous tissue. The skin in this

abdominal area that shows alopecia is infiltrated, or at least the subcutaneous tissues are, and, by their bulging forward, have the appearance of skin nodules. This infiltration is unevenly distributed and has the appearance of fat, but is more granular. A smear is made from this fatty-like substance for microscopical examination, which shows many hundred acid-fast bacilli. There is more congestion of the blood vessels in the inguinal areas than under the skin of the rest of the abdomen, but no enlargement nor other pathological changes are noted in the inguinal glands. The axillary glands are also normal in appearance.

The abdominal cavity is opened. Previous to opening this cavity it is noticed that there is a bulging of its anterior wall. Upon opening the abdominal cavity it is found that this bulging is due to the fatty-like substance deposited in the omentum and to the large size of the spleen, which is also encased in this fatty-like material. This latter organ measured 7½ centimeters in length, 2½ centimeters in breadth, and nearly 1 centimeter in thickness, and is easily five times the normal size of the spleen of a rat. The weight of this organ is 7.3 grams. Incision is made through this organ, and it is found that this fatty-like appearance is not confined to the capsules, but that the whole organ has the appearance of a piece of tallow, with here and there a small red spot, indicating where the larger vessels are severed. There is no demarkation between the pulp of the organ and the capsule. Three smears are made from the cut surface of this organ for microscopical examination, and many hundreds of acid-fast bacilli were found in each field of the three slides examined.[a]

The liver is next examined. This organ is found to be considerably enlarged, extending far below the center of the abdomen and has the same whitish, tallow-like appearance noticed in the spleen. It cuts with a slight grade, is rather firm. Its cut surface is similar in appearance to the cut surface of the spleen, having the whitish, tallow-like look throughout the organ. Two slides are made from this organ, the microscopical examination of which reveals an average of 50 to 100 acid-fast bacilli per field. The intestines appear normal, except for a hemorrhage, which has filled a portion of the small intestines with blood. The kidneys are normal in size and appearance.

The thorax is next opened. Lungs collapse completely; organ removed is found to be quite normal in size and appearance, except for an edema, probably terminal in character. The color of the organ is darker than normal. Several sections were made through the organ, but the most critical examination could not elicit anything but an edema. As a matter of routine, two smears are made from the cut surface of the lung for examination, which results in the finding of at least 50 acid-fast bacilli per oil immersion field.

In the median line, posteriorily and in the upper portion of the thorax, is located a large tumor, examination of which shows that it is an immensely enlarged mediastinal gland. It is removed and found to be quite firm in character and white in color. It is a trifle over 2 centimeters in length and a little over 1 centimeter in breadth. The thickness can not be accurately ascertained, but it is less than one-half centimeter. Nothing now existing in the lung accounts for this condition in this gland, and it is therefore probable that a pneumonia has existed in the animal, from which it recovered, especially as this corresponds to the animal's symptoms in May. Smears are made from the cut surface of this gland for microscopical examination, which shows many hundreds of acid-fast bacilli per oil immersion field.

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[a] Sections of this organ were stained with hematoxylin and eosin and examined; there is found to be dilatation of the blood vessels, round-cell infiltration, and areas of coagulation necrosis.

Comment.—From the known clinical symptoms of this animal, which afterwards improved, only to later develop alopecia and infiltration of the skin, together with the autopsy findings, indicates that this animal suffered from pneumonia in May last, from which it recovered, the only evidence of the pneumonia remaining at autopsy being the enlarged mediastinal gland.

Rat IX.

This animal was one of those that were suffering, as previously mentioned, in May, from dyspnœa and other symptoms, exactly like those symptoms from which the rats that died had suffered. This animal recovered from these pneumonic symptoms and was apparently well for a time, when it developed alopecia. The only other symptom noticed was that these four rats, of which this is one, were quieter than normal and that their hair presented a ruffled appearance.

Animal was chloroformed on August 11 and body examined. Area of alopecia, 8 to 9 centimeters square, was found over the skin of the back, just above the root of the tail; this area was irregular in shape, extending laterally to the right, on the flank of the animal. The abdomen showed no large area of alopecia, but there was a patchy loss of hair over the whole abdominal surface. No nodules could be discovered on palpating the skin of the animal. No ulcerations were noted. Animal skinned; the whole lower inner surface of the abdomen shows a fatty-like infiltration of the subcutaneous tissues. Except for the amount of it, it would be impossible to say that it was not normal fat. A smear made from it and stained showed immense numbers of rat lepra bacilli, showing that this was a rat leprous infiltration and not true fat. Under the area of alopecia is another such infiltration. Except in the areas mentioned, the subcutaneous tissue of the animal is perfectly normal; neither inguinal nor axillary glands are enlarged.

Omentum found to be loaded with fat. Intestines encased in fat, as are the kidneys. The amount and appearance of this fat-like substance, judging from our previous experience, indicated that this was a part of the disease rather than true fat from excessive nutrition. Smears were made from the omental fat-like substance, which was found to be almost pure oil, and for this reason could only be fixed with difficulty to the slide. Repeated attempts fail to stain bacilli in the smears from this material. It was thought possible that the excess of oil prevented the organism from taking the stain, but a drop of the fluid, examined under low light, failed to show bacilli floating in such fluid.

The spleen appears perfectly normal, as does the liver and the kidneys, and smears made from the spleen show only one rat lepra bacillus to five oil immersion fields, on an average. Thoracic cavity is next opened; lungs appear perfectly normal, no enlargement of the mediastinal glands. Smears made from the lungs, stained in the ordinary manner, show no rat lepra bacilli. Heart opened. Smear made from the heart blood, stained in the usual manner and examined, with the result that no rat lepra bacilli were found.

Five mites (*Lælaps echidninus*) were captured from the skin of this animal, these representing all the parasites present on this animal, which is rather remarkable in comparison to our experience with some of the other rats. Of these five parasites, four were blood-filled; their bodies were crushed and stained in the usual manner, but no rat lepra bacilli were present.

Comment.—The clinical symptoms of this animal and the necropsy findings in the case of its fellows that died of the same symptoms, forces us to conclude that this animal, like its fellows, sickened in May from rat leprous pneumonia; that it recovered from this condition; that there later developed typical rat lepra

of the subcutaneous tissues. Attention is called to the absence of septicæmia in this animal at the time of necropsy, and therefore the absence of rat lepra bacilli in the mites feeding on the animal.

Seven healthy white rats were inoculated on August 11, 1910, from the subcutaneous tissues of Rat IX, inoculating them by the subcutaneous method at the root of tail.

Rat X.

The clinical symptoms and subsequent course in this rat were practically identical with those of Rat IX, the only observable difference during the life of the animal being that the alopecia was scattered more over the body, being of a patchy character and showing no large areas of involvement.

Animal chloroformed on August 11. Body examined and it is found that these numerous small areas of alopecia also show excoriation of the skin, which lesions are covered by a crust. The animal is skinned, the subcutaneous tissue from the pubis to the junction of thorax and neck, over the whole abdominal surface, is one mass of leprous infiltration. The flanks and back, however, show no such lesions. None of the superficial lymph nodes are involved. The subcutaneous tissue infiltration is, like in the case of the rat just autopsied, fat-like in character, but of more granular appearance, and with a little more tendency to a pinkish color than in Rat IX. Smear made from this substance and stained in the usual manner showed an immense number of rat lepra bacilli.

Testes dissected and found to be incased in a fat-like material. The right testicle is excised under aseptic precautions. Smear made from the cut surface of this testicle shows an average of three to four rat lepra bacilli per microscopical field, one field showing a clump of 20 bacilli.

Abdominal cavity opened; all abdominal organs macroscopically normal. Considerable fat-like material encasing both kidneys, which substance follows down the course of the ureters. Smears made from it are found to consist only of fluid fat, which refuses to take the stain. Examined fresh specimens, but found nothing resembling bacilli floating in this oily material.

Thoracic cavity opened: Heart and blood perfectly normal, no enlargement of the mediastinal glands. Smears made from the viscera and heart blood are negative as to acid-fast bacilli, except the spleen, which contained an average of 1 bacillus per 15 microscopical fields.

Eight mites (*Lælaps echidninus*) were captured from this animal. They were smeared, stained, and examined, but showed no rat lepra bacilli.

Comment.—The conclusions we reach in this rat are the same as those in the case of Rat IX.

Eight healthy white rats were inoculated on August 11, 1910, from the subcutaneous tissues of Rat X, inoculating them by the subcutaneous method of root of tail.

Rat XI.

This animal, like Rats IX and X, sickened in May with pneumonic symptoms, similar to the others, recovered from these symptoms, and at the present time appears to be in perfectly good health, except that the hair is a little roughened up and shows a slight thinning, but no distinct alopecia.

The animal is chloroformed and skinned. Greater portion of the abdominal area shows typical rat leprous infiltration of the subcutaneous tissues, a smear of which shows many rat lepra bacilli.

Abdominal cavity opened. Intestines incased in this fatty-like material, which is also deposited in the omentum about kidneys and spleen. Spleen itself is normal in appearance, as is the liver and other abdominal viscera. Smear made from the spleen shows no rat lepra bacilli.

Thorax opened: Lungs perfectly normal in appearance, no enlargement of mediastinal glands. Heart cavity opened. Smear made from heart blood and cut surface of lung show no rat lepra bacilli.

Nine mites (*Lælaps echidninus*) were captured from this animal, smeared, stained, and examined, but found to contain no rat lepra bacilli.

Rat XII.

This, like the other animals just recorded, is one of those that in May showed pneumonic symptoms, consisting of accelerated respiration, weakness, etc. Since then respiration has been normal, there being no noticeable symptoms of any kind, except a slowly developing patch of alopecia at the root of the tail. At the time of necropsy this was about the size of a 25-cent piece and absolute in character. Several small patches were also found scattered over the abdominal surface.

Subcutaneous tissues over abdominal surface are infiltrated, right axillary gland is found to be enlarged to three times its normal size. Smears made from the subcutaneous tissue and gland show large numbers of the bacilli of rat leprosy.

Abdominal cavity opened: Spleen and liver appear normal. Smear made from spleen shows no rat lepra bacilli.

Thoracic cavity opened: Lungs appear normal, except the right lung, which shows three small areas of a rough triangular shape near its base, each area being about the size of one-half of a pea. These are deeply red in color, thrown into water they sink. The shape and color suggest that they may be infarcts, but a positive opinion can not be formed until histological studies have been made. Smears made show from one to five rat lepra bacilli.

Histological examination: One specimen is stained with Van Gieson's connective tissue stain and another with hematoxylin and eosin. Walls of bronchi much thickened, this thickening due in part to swelling of bronchial mucosa, but chiefly to an increase in the connective tissue sheath around bronchi. The walls surrounding the air sacs are greatly thickened, and these walls take Van Gieson's stain deeply. Air sacs filled with leucocytes; but little fibrin present. Blood vessels dilated. Diagnosis: Pneumonia with interstitial increase.

CULTURAL ATTEMPTS.

All the cultures on ordinary media, including glycerine-agar and glycerine-glucose agar remained sterile so far as acid-fast bacilli were concerned. We attempted to cultivate the rat lepra bacillus by the method first successfully employed by Clegg for cultivating the human lepra bacillus (and confirmed by Currie, Brinckerhoff, and Hollmann). At the present writing we are not able to report any success in these culture attempts in the case of the bacillus of rat leprosy, but we will carry this work on and report again later.

DISCUSSION.

It is recognized that in the case of these 12 rats we may have been dealing with an example of an unusual mode of onset of this disease. It is also recognized that these animals were inoculated artificially by the subcutaneous method and that under natural conditions this disease may have an entirely different mode of onset. We shall therefore not presume to generalize or point out the possible significance of these observations, but will confine our conclusions to the cases of the above-described animals and hope to present further data on this subject at some future date.

CONCLUSIONS.

The conclusions which we draw from these 12 rats are as follows:

I. In some cases of artificially acquired rat leprosy the onset is with broucho-pneumonia, accompanied by a septicæmia and without other demonstrable lesions.

II. In other cases of this disease pneumonia is a very early lesion, hnt we can not positively state that it is always the first lesion.

III. That the animal may die in the pueumonic stage before other lesions present themselves or it may develop pneumonic symptoms and recover from the same only to later develop the well-known lesions of chronic rat leprosy; or, again, the pnenmonia may persist until after the development of the lesions of the skin and abdominal visceræ.

IV. That during the stage of the disease in which the animal is very ill certain mites (*Lælaps echidninus*) were found to be very numerous on the animals' bodies.

V. That during the stage of the disease in which septicæmia is marked these mites' digestive tracts contain the bacilli of rat leprosy in considerable numbers, and therefore these parasites may be one means of transmitting the disease. This latter probability, however, is, of conrse, not proven.

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DISINFECTANTS, THEIR USE AND APPLICATION IN THE PREVENTION OF COMMUNICABLE DISEASES

BY

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DISINFECTANTS, THEIR USE AND APPLICATION IN THE PREVENTION OF COMMUNICABLE DISEASES.

[From the Hygienic Laboratory.]

By Passed Asst. Surg. THOMAS B. MCCLINTIC.

INTRODUCTION.

As is generally understood, disinfection is the destroying of disease-germs, thus rendering the organisms inert and harmless. Using the term in a broad sense it may be made, also, to include the destruction of disease-carrying insects, as the processes are usually carried out along the same general lines. The infective organisms of the communicable diseases are, with few exceptions, much more easily killed by disinfectants than are some of the common spore-bearing and highly resisting saprophytic bacteria usually present in all localities, but as nothing would be gained by carrying the operation to the extent of killing the latter class of nonpathogenic organisms, the process of disinfection is usually one of degree only; in other words, it is not necessarily carried to the point of complete sterilization. The specific germ of some of the infectious diseases, such as smallpox, scarlet fever, and measles, has not yet been positively demonstrated; nevertheless experience has proven that the infection of these diseases can be destroyed by the intelligent and proper use of disinfectants.

The question then naturally arises as to the best methods of accomplishing disinfection. The ideal disinfectant will in all probability never be found, and consequently there will always be encountered more or less antagonism against disinfection, for, as Rosenau[1] aptly states, "the stress of modern activities demands disinfection processes that are instantaneous in their action, all pervading in their effect, cheap, harmless, and free from any unpleasant odors that might offend the senses of the fastidious. Such perfect disinfectants are unknown. It requires time, money, and the expenditure of well-directed and intelligent energy to accomplish satisfactory disinfection."

[1] Rosenau, M. J.: "Disinfection and Disinfectants," 1902, p. 32.

If the claims for some of the numerous proprietary disinfectants offered for sale upon the market were actually fulfilled, the process of disinfection would be very much simplified, but unfortunately this is not true, and in order to insure efficient results it is necessary to fall back upon the use of the old standard disinfectants that have stood the test of time and are known to be trustworthy. It should be borne in mind, too, that with the advance in medical science disinfection as intelligently applied to-day is far more specific than it formerly was and that the shotgun methods of former years have gradually passed into disfavor.

Without any pretense to originality, it will be endeavored to give here, in a simple and concise manner, the best methods of using disinfectants, and the special application of these methods in the eradication and prevention of some of the infectious diseases, with the hope that it may be of service, particularly to those more or less unfamiliar with the methods and technique of disinfection. The methods of disinfection, particularly the simpler ones, will first be described and then their special uses and applications will be given.

PART I.

DISINFECTANTS.

Disinfectants are usually divided into the following general classes:

(1) Physical agents, including sunlight, dry heat, burning, boiling, steaming, electricity, etc.

(2) Gaseous, including formaldehyd, sulphur dioxid, chlorin, etc.

(3) Chemical solutions, including bichlorid of mercury, formalin, carbolic acid, tricresol, lysol, creolin, potassium permanganate, lime, chlorinated lime, the hypochlorites, etc.

With the exception of heat, sulphur dioxid is the only one of the above-mentioned disinfectants that is used to any extent as an insecticide, while other substances used for this purpose are hydrocyanic acid gas, pyrethrum, petroleum, etc. As the uses of the physical agents, particularly the different forms of heat, are more or less familiar to all, they will not be further discussed in this paper, but the other disinfectants will be considered.

Gaseous Disinfectants.

In determining the quantities of disinfectant substances to be used for gaseous disinfection, the cubic contents of the space to be disinfected is always estimated, and usually expressed in terms of a thousand cubic feet.

A room, each dimension of which is 10 feet, contains 1,000 cubic feet, and the cubic contents of any space can be determined by multiplying together the length, width, and height, expressed in feet, which will give the contents in cubic feet.

To prevent the escape of the gas from the inclosure to be disinfected, fireplaces, ventilators, cracks of doors and windows, and other openings can be stuffed with cotton, paper, cloths, etc., but they are best closed by pasting them up, for which purpose strips of newspaper and a paste made from flour can be used.

All articles to be disinfected should be well exposed to the action of the disinfectant, as the penetrating powers of all gaseous disinfectants are more or less limited, therefore they should either be hung up or otherwise freely exposed to the gas.

FORMALDEHYD.

For disinfection purposes formaldehyd gas is usually produced from the aqueous solution of the gas, the official (U. S. P.) name of which is "solution of formaldehyd." The common commercial name for it, however, is "formalin," and since this name has been used in designating one of the principal methods of producing the gas, namely, the "formalin-permanganate" method, the solution will be referred to under the name of "formalin" in this paper.

Formalin is supposed to contain 40 per cent of formaldehyd gas by volume, but from evaporation and deterioration it often falls short of this quantity, seldom containing more than 37 per cent of the gas. The gas, when used under favorable conditions, is one of the most powerful germicides at our disposal. In addition to its germicidal efficiency it has the unique advantage over most other disinfectants in that it is not injurious to the ordinary household furnishings. Furniture, carpets, wall hangings, paintings, wearing apparel, and fabrics, with the possible exception of some of the very delicate anilin colors and polished steel, are unaffected by long exposures to the action of this gas.

It acts quickly as a germicide, but its powers of penetration are limited, so that it is necessary to have articles freely exposed in order to insure thorough disinfection. On account of lack of penetrating power it is evident that formaldehyd gas can not be depended upon to disinfect mattresses, upholstered furniture, or articles of that class requiring deep penetration; consequently after exposing them to formaldehyd gas they should be either burned, boiled, steamed (under pressure), or soaked in a disinfectant solution in order to make sure of destroying all possible infection.

Unfortunately the germicidal powers of formaldehyd are markedly affected by climatic conditions. With the temperature and humidity of the ordinary summer in the United States its efficiency as a surface disinfectant is unquestioned, but when the temperature is about or below 50° F., or the moisture in the atmosphere is below 60 per cent of saturation, the efficiency of formaldehyd is very much reduced. The temperature and humidity being below the points stated, polymerization of a portion of the formaldehyd takes place and its power of penetration, which at best is only slight, is still further diminished. These effects of low temperature and humidity may in part be overcome in room disinfection by artificial heating and at the same time boiling water in the room, by sprinkling the floors with water, and also by using an increased quantity of formaldehyd.

Formaldehyd gas is useless as an insecticide and is practically never used for that purpose. Flies and mosquitoes are killed by it only after a long exposure to the gas in concentrated form. It is nontoxic to the higher forms of animal life, including man, but produces in

them an irritation of the respiratory, nasal, and ocular mucous membranes, thus causing coughing. sneezing, and "watering" of the eyes. Unless the exposure is prolonged these effects, however, are only temporary and pass off when no longer exposed to the gas.

Formerly formaldehyd gas was largely produced by means of generators, lamps, autoclaves, etc., methods requiring special apparatus and a certain amount of mechanical skill in operating, but those methods have now largely been supplanted by simpler ones which can be used in any household. In view of this fact the instrumental methods will not be dealt with in this paper, but the following methods of evolving the gas will be described:

(1) Formalin-permanganate method.
(2) Formalin-sheet-spraying method.
(3) Formalin-aluminum sulphate-lime method.
(4) Paraform.

Regardless of which method is used, everything should be in readiness before the disinfection process is started. All trunks and drawers should be opened and most of the contained articles hung up or otherwise exposed in the room, particularly if there is a possibility of their being infected. All cupboards, closets, and bookcases should be opened.

Fireplaces, ventilators, and cracks of doors and windows to be closed should, with the exception of the doors of exit, be closed before the disinfection process is started.

To get rid of the formaldehyd gas remaining after disinfection it is usually sufficient to open the doors and windows and allow it to blow out. Ammonia was formerly used to a limited extent for neutralizing the gas, but, as it often causes a portion of it to precipitate in the form of a powder, which, when heated or moistened, will again give off a certain amount of formaldehyd gas, ammonia is now seldom used for that purpose. Even when the formaldehyd is allowed to blow out the odor of the gas is often perceptible for several days following disinfection. This, however, causes no trouble or inconvenience.

After disinfection with formaldehyd the quarters can usually be occupied an hour or two after opening the doors and windows.

Formalin-Permanganate Method.

When formalin is poured upon crystals of permanganate of potash a vigorous reaction takes place, accompanied by strong ebullition of the liquid and sufficient heat to produce a large quantity of formaldehyd gas, water, vapor, etc. The time required for the reaction to begin, or at least to become apparent, varies from a few seconds to a minute or two, depending upon the temperature. The reaction is

apparently over in a few minutes and with proper proportions of substances the residue in the vessel is almost dry.

A convenient and efficient proportion to use is two parts of formalin to one part of permanganate, or in the proportion of a quart of the former to a pound (pint) of the latter. By using a greater proportion of permanganate than this, slightly more gas may be evolved from the formalin, but in addition to requiring an increased expenditure of permanganate the danger of fire is also increased, as formaldehyd gas in a comparatively dry state is inflammable. The increased oxidation resulting from the additional permanganate is therefore more liable to cause combustion of the gas than when the proportions are used as just stated.

For mixing the formalin and permanganate a large galvanized-iron pail is very suitable. Pots or earthen vessels, usually being thick, are not as suitable as thin pails, on account of absorbing much heat from the reaction. The pail, though, may be heated before mixing the formalin and permanganate. On account of the vigorous ebullition during the reaction a 10-quart pail should be used for mixing therein 10 ounces of formalin and 5 ounces of permanganate. Even then a few drops of the mixture may be thrown over, so that it is well to place the pail in a large tin pan or upon something to protect the carpet or floor. To prevent this sputtering over there is some advantage in using a pail with a flared top. As the process is attended with slight danger of fire, the reaction, which is quickly over, should be watched through a window or the pails placed upon a noninflammable surface.

With this method the formaldehyd gas is evolved so quickly and in such a large volume that it is unnecessary, in houses with well-fitting doors and windows, to paste up cracks unless only a portion of the house is to be disinfected and the remainder is to continue to be occupied.

Closets, drawers, trunks, etc., should be opened, and when everything is in readiness the permanganate is placed in the pail and the formalin poured over it. In disinfecting an entire house all inside communicating doors, halls, etc., should be opened and at least one pail placed in each room and hall, unless the rooms are very small. Large rooms may require more than one pail unless a pail proportionately large is used.

The quantity of formalin and permanganate to be used per 1,000 cubic feet of room space depends upon conditions. If the atmosphere is warm and humid 10 ounces of formalin and 5 ounces of permanganate is sufficient, while if it is dry and cold double these quantities should be used. The pails should be placed about in the room or rooms as stated and the necessary quantity of permanganate weighed and placed in them; the formalin for each pail should then be measured

into a wide-mouthed cup or vessel and placed by the pail in which it is to be used. Do not use narrow-necked bottles or the pouring will require too much time. Although the reaction of formalin with permanganate takes place quickly, by making preparations as advised one operator can " set off " a number of pails, there being nothing to do except to pour the formalin over the permanganate. Of course the mixing should begin in the rooms most distant from the door of exit.

The time of exposure—that is, the time the premises should be kept closed—should be at least two and, preferably, four hours. At the end of this time the doors and windows are opened and the gas allowed to blow out.

The cost of formalin is about $1.35 per gallon. The cost of permanganate of potash is about $0.16 per pound.

FORMALIN-SHEET-SPRAYING METHOD.

This is a very simple and inexpensive method of evolving formaldehyd gas from formalin, and when properly used under favorable conditions is efficient. Formalin, sheets, and a means of spraying the formalin upon the sheets, are all that are required in the way of appliances. The sheets should be hung up over a cord or line and allowed to hang at an angle of about 45°, and it is of advantage, too, to slightly dampen them with water before hanging them up, as the formalin will then be quickly absorbed and lessen its tendency to run off the sheets.

The formalin should be evenly sprayed upon the sheets, which can be done with any spraying device, a very simple one being a flower-watering pot provided with a sprinkler. The spraying should be done rather quickly, as the gas soon begins to be given off. The process should be carried out in each room. Not over 10 ounces of formalin should be used for every 30 square feet of sheet surface. The area of a sheet is found by multiplying its length by its breadth.

This method is particularly applicable where a long exposure may be allowed, as the gas is gradually given off and the percentage of formaldehyd remains comparatively high during a relatively long time. This method should not be used at temperatures below 60° F., as the formalin polymerizes on the sheets and very little gas is liberated. With fairly close-fitting doors and windows, pasting of cracks is unnecessary, unless a strong wind is blowing. However, large openings like fireplaces, openings into chimneys, ventilators, etc., should be closed either by pasting or with bunches of old rags.

As this method should be used only during warm months, 10 or 12 ounces of formalin for each 1,000 cubic feet of air space is sufficient.

The time of exposure should be from four to six hours. Open the doors and windows and, when possible, remove the sheets. The sheets are not injured in any way by the formalin.

FORMALIN-ALUMINUM SULPHATE-LIME METHOD.

In this method 2½ pounds of commercial aluminum sulphate are dissolved in 2 quarts of hot water and allowed to stand for a few hours. To 1 quart of this solution, 3 quarts of formalin are added. To evolve formaldehyd gas from this later solution it is poured over unslaked lime in the proportion of 10 ounces of the solution to 1 pound of lime. Just before using the lime it should be broken into small particles. It should slake easily in cold water. The lime should be placed in a pail or vessel and the solution poured over it. A few minutes after pouring the formalin-aluminum sulphate solution over the lime, the latter begins to slake and continues for 20 to 30 minutes during which time formaldehyd, steam, etc., are given off. The percentage of formaldehyd gas liberated by this method is relatively small as compared with the formalin-permanganate method, but since a small quantity of formaldehyd is efficient when used under favorable climatic conditions this method will then give efficient results. This method, though, should *not* be used in cold, dry weather.

About 15 ounces of formalin-aluminum sulphate solution, made as described above, and 1½ pounds of lime should be used for each 1,000 cubic feet of air space. Cracks should be pasted up and fireplaces and ventilators closed, as the percentage of gas given off is relatively small. The time of exposure should be from four to six hours. The process should be carried out in each room.

This method of evolving formaldehyd gas has no advantages, but several disadvantages, as compared with the formalin-permanganate method, and is now seldom used. It is not as efficient as the sheet-spraying method.

The cost of formalin is about $1.35 per gallon and of aluminum sulphate about $0.15 per pound. The cost of unslaked lime, when available, is usually very small.

PARAFORM.

Paraform can be used, particularly for disinfecting small inclosures, under the same conditions of heat and moisture as already stated with regard to the other methods.

Paraform is one of the polymeric forms of formaldehyd. It is a white powder and readily burns with a blue flame. For disinfecting purposes it should be heated to convert the paraform into formaldehyd gas, but *under no condition* should it be allowed to burn, as the combustion destroys practically all of the formaldehyd. A good method of producing formaldehyd gas from paraform is to place the paraform in a metal utensil under which a lamp or alcohol flame can be placed. A special lamp or device can be obtained for the purpose, but an ordinary pint tin cup will suffice for heating therein an ounce

or two of paraform. The paraform is placed in the cup and a flame applied underneath. The flame should not be too strong, for should the paraform ignite no formaldehyd gas will be produced and there will be no disinfection. The space to be disinfected should be tightly closed and all cracks pasted up. For each 1,000 cubic feet of air space two ounces of paraform should be used. The time of exposure should be about four hours. If necessary, the flame under the utensil containing the paraform can be left burning during the time of exposure.

A solution of paraform can be made and used in the same manner that formalin is used in the formalin-permanganate method. For disinfecting 1,000 cubic feet of space 2 ounces of paraform are dissolved in 8 ounces of boiling water. This solution is then poured over 5 ounces of permanganate of potash contained in a 2-gallon pail, the details of procedure being the same as have been described for the formalin-permanganate method.

There are many forms of candles and other preparations of paraform made and sold upon the market for disinfection purposes, but bear in mind that any preparation of paraform requiring that the preparation be ignited and burned in order to produce formaldehyd gas is useless for disinfection purposes, as the formaldehyd is destroyed by the combustion.

In using those preparations of paraform that are heated to produce the gas, due allowance must be made for other ingredients than paraform contained therein, and therefore a larger quantity should be used than when using pure paraform, as at least 2 ounces of paraform should be used for each 1,000 cubic feet of space to be disinfected. For the reasons stated the use, for disinfection purposes, of proprietary preparations of paraform of unknown strengths should as far as possible be avoided.

SULPHUR DIOXID.

In the presence of moisture sulphur dioxid is an efficient surface disinfectant. Its powers of penetration are limited and it will not kill spores, but when used under favorable conditions it will kill the contagion of most of the infectious diseases not due to spore-bearing organisms. Dry sulphur dioxid (SO_2) is practically without germicidal powers, but in the presence of moisture this gas is converted into sulphurous acid gas (SO_3) and sulphuric acid (H_2SO_4), upon which efficient disinfection with sulphur gas depends. While these converted products are destructive to germ life, they are also injurious to household furnishings, fabrics, etc., which is one of the greatest drawbacks to the use of sulphur gas as a disinfectant. These injurious effects and the feeble germicidal properties of the gas in the dry state, have greatly limited its uses, particularly in household disinfection, but it is still especially applicable for destroying rats, flies, fleas, and other vermin that spread contagion, since it is highly

fatal to animal life. It is, therefore, applicable and largely used for disinfecting holds of ships, stables, barns, granaries, freight cars, and structures of this character. Sulphur, either as flowers or in rolls or sticks, can usually be obtained at any drug or crossroads store.

In the presence of moisture sulphur dioxid attacks and causes oxidation of most of the metals, which, however, can be prevented by previously vaselining the exposed surfaces; it bleaches and injures cotton, linen, and woolen fabrics, curtains, etc.; it injures flour, except in the closed ("headed up") barrel; it softens paint and varnish, particularly if they have been recently applied; it injures soap, coffee, tea, sugar, rice, matches, etc., when they are freely exposed to it; it injures clocks; and it discolors wall paper if moisture is present.

The moisture necessary in destroying germ life with sulphur dioxid can usually be artificially produced without difficulty, as it can be added in the form of steam (sulphur furnace), and in the pot method it is automatically produced from the water in the pan in which the sulphur pot is placed. However, when using sulphur dioxid as a disinfectant in damp weather or in disinfecting holds of ships which are usually damp, the artificial production of moisture is unnecessary.

The inclosure to be disinfected with sulphur gas should be made as tight as possible, therefore the cracks of doors, windows, and keyholes should be pasted up; fireplaces, ventilators, radiators, and all openings should be tightly closed, either by pasting them up or in some other manner. This should all be done, except the door of exit, before starting the disinfection. For pasting, strips of paper and a paste made from flour can be used. After the disinfection is over, the pastings can be moistened with water and washed off. It is necessary, to avoid injury to the articles enumerated above, to remove them from the space to be disinfected. Brass or any metal furnishings are not injured, provided they are given a thin coating of vaseline.

The principal methods of using sulphur dioxid are:

(1) The pot method.

(2) Liquid sulphur dioxid.

(3) Sulphur candles.

(4) Sulphur furnace.

Owing to the special apparatus required, the sulphur furnace will not be dealt with in this paper.[1]

[1] Passed Asst. Surg. Norman Roberts is now perfecting, at the Hygienic Laboratory, a portable stove for burning sulphur in the production of sulphur dioxid gas. The great advantage of the stove is that it burns the sulphur and produces the gas much faster than do any of the other methods described. The stove consists of several pans, which furnish a relatively large area for burning the sulphur, and as the pans are placed the one above the other in inverse step fashion, viz, the pans at the top are broader than those at the bottom, the heat from the pans beneath assist in heating the pans above. With equal burning surfaces, this stove burns the sulphur apparently three or four times as fast as it is burned by the pot method. The stove is very cheap and, depending upon the size, varies in weight from about 5 to 40 pounds.

THE POT METHOD.

This is the cheapest and simplest method of producing sulphur dioxid. The only materials required are pots, sulphur, and a small quantity of alcohol. Sulphur burns when liberally sprinkled with alcohol and lighted. It can also be started burning by placing a shovelful of hot coals of fire into it. As sulphur dioxid is produced by combustion of the sulphur, and as the combustion is dependent upon the available oxygen of the air, it will readily be seen that the rapidity of production of the sulphur gas will be governed by the area of the burning surface. It is therefore very important for rapid production that broad shallow pots be used.

Ordinary "Dutch ovens," iron buckets, etc., may be used, but the best pot for the purpose is one with a flat bottom, 12 to 18 inches in diameter, and with sides about 4 inches high. A dishpan answers the purpose very well.

Theoretically, the complete combustion of 1 pound of sulphur in a space of 1,000 cubic feet produces 1.15 per cent of sulphur dioxid, though 1 per cent is about what is produced in actual practice. Therefore, as 5 per cent is required to kill nonspore-bearing organisms, it is necessary to burn 5 pounds of sulphur for each 1,000 cubic feet of space to be disinfected.

After estimating the cubic space to be disinfected the sulphur should be weighed, allowing 5 pounds for every 1,000 cubic feet of space.

Sufficient pots should be available so that a depth of not more than 1½ to 2 inches of sulphur will have to be placed in each pot, although necessity sometimes requires a greater depth than this. The sulphur should be sloped toward the center so as to form a crater or depression in the center.

When using stick sulphur a portion of it should be pulverized or broken up. The pots should be distributed in the rooms to be disinfected according to the size of the rooms and number of pots. They may be placed upon the floor, tables, stoves, hearths, etc.

It should be borne in mind that the burning sulphur causes the pots to become very hot, and to avoid danger from fire it is necessary to place them upon objects not combustible or injured by heat. As already stated, this is best accomplished by placing them in pans containing an inch or two of water, as, besides the protection, the heat produces moisture from the water, which is necessary in sulphur disinfection. Pans not being available, the pots may be placed upon earthen or metal surfaces and efficient disinfection done, provided the atmosphere is reasonably damp. Theoretically, about 3 ounces of water should be volatilized for each pound of sulphur burned. The sprinkling of the sulphur with alcohol and lighting

should not be done until everything is in readiness. A convenient and safe method of lighting the alcohol in the pots is to strike a match and before the head is entirely ignited to throw it into the pot. This will cause the alcohol to ignite. After lighting, the sulphur fumes do not begin to come off for a few minutes, so that one operator can start a number of pots. After lighting the pots, observe that they are all burning; then close the door of exit and paste up its cracks.

When the sulphur has been burning half an hour, search for sulphur fumes escaping from any openings that may have been overlooked and close them.

Leave the apartment or room closed for 12 hours, and then open doors, windows, etc., and allow the remaining sulphur fumes to blow out. It is well to have the windows so they can be opened from the outside, otherwise entrance to the rooms may be impossible for an hour or so. The rooms can usually be occupied in two or three hours after opening the doors and windows.

LIQUID SULPHUR DIOXID.

The technique of disinfection with liquid sulphur dioxid differs from the pot method only in the manner of production, therefore that is the only phase of the subject that will be described here, the reader being referred to the description already given for further details.

The method has the advantage of liberating a large quantity of sulphur dioxid in a short time, but it is a far more expensive method than burning sulphur by the pot method, the relative cost being about 10 to 1. The method of using liquid sulphur dioxid, however, is very simple and it is free from any danger of fire. The liquid is prepared commercially and is usually obtained in metal cans or casks, which for use only require the simultaneous cutting of the leaden pipes on the tops of the necessary number of cans and the inversion of the latter in a metal or earthen vessel, when volatilization rapidly takes place.

To obtain the 5 per cent of sulphur dioxid required for disinfection, it is necessary to use 10 pounds of liquid sulphur dioxid for every 1,000 cubic feet of air space. Therefore, the space should be estimated and the required quantity of liquid dioxid obtained. Of course, with this method the same preparations and precautions with regard to injury of certain articles should be carried out as with the pot method. If a number of adjoining rooms are to be disinfected, it is best to begin opening and inverting the cans in the most distant rooms and work toward the door of exit. It is necessary to have everything in readiness and to work quickly as the gas is given off rapidly. If the container of the liquid dioxid is provided with a

siphon or tube the liquid can be introduced by means of a tube through the keyhole into a suitable receptacle inside the room.

The time of exposure should be 12 hours.

One striking disadvantage of this method as compared with the pot method is that it produces no moisture, which is necessary to obtain the maximum disinfecting power of sulphur dioxid.

SULPHUR CANDLES.

As sulphur candles are applicable only for killing insects and not for disinfection purposes the method of using them will be described under sulphur as an insecticide.

CHLORIN.

Owing to its poisonous and destructive properties, chlorin is very seldom used as a disinfectant. Moisture is necessary for its action as a disinfectant, and in the presence of moisture it is also a powerful bleaching agent for all the organic pigments. Carpets, curtains, and fabrics generally are injured by its action. It is destructive to both animal and plant life. According to Rosenau[1] the most convenient method of generating the gas is by decomposing 1½ pounds of chlorid of lime with 6 ounces of strong sulphuric acid. This produces sufficient gas for the disinfection of 1,000 cubic feet of air space. Another method of generating chlorin gas is by adding four parts of strong hydrochloric acid to one part of magnesium dioxid. For practical purposes of disinfection, according to Munson,[2] free chlorin is much inferior to sulphur dioxid, since it is more difficult to control, more dangerous to manipulate, and more destructive in its effects.

CHEMICAL SOLUTIONS.

BICHLORID OF MERCURY.

This substance is also known as corrosive sublimate, bichlorid, and mercuric chlorid. In the pure state it is a white crystalline substance and fairly soluble in water, thus differing from calomel (mercurous chlorid), which is a white amorphous powder and insoluble in water.

The "antiseptic tablets" sold on the market are usually composed of bichlorid of mercury. These tablets are generally artificially colored (blue) in order to lessen the chances of accidental poisoning with them, as bichlorid of mercury dissolved in water makes a perfectly clear solution.

Bichlorid of mercury is one of the most powerful germicides that we possess. It has the disadvantages, however, of corroding metals,

[1] Rosenau, M. J.: "Disinfection and Disinfectants," 1902, p. 142.
[2] Munson, "Military Hygiene," p. 786.

forming inert compounds with albuminous matter and of being very poisonous. It is therefore inadvisable to use it for disinfecting sputum, excreta, or under any condition in which it comes in contact with much albuminous or organic matter, since it forms inert compounds with these substances.

One part of bichlorid of mercury will dissolve in 16 parts of cold water and in three parts of boiling water. The bichlorid should be pulverized before attempting to dissolve it. Even then it dissolves with some difficulty. The solubility is increased by using sea water for the solution or by adding two parts per 1,000 of sodium chlorid (common salt) to the water employed. The water used should be free from organic matter and for dissolving the bichlorid it is preferable that the water be hot.

The strength of solution used in disinfecting for the infectious diseases is usually 1 part of bichlorid to 1,000 parts of water, viz, a strength of 1 to 1,000. This solution is made by dissolving 1 ounce of bichlorid in 1,000 ounces of water—approximately 8 gallons; a 1 to 500 solution is made by dissolving 1 ounce in 500 ounces of water, and so on for any other strength desired. The solutions are best made in an earthen or wooden vessel, a washtub or barrel being very suitable. The addition of a little indigo or other coloring matter will avoid the possibility of the solution being drunk by mistake.

To disinfect soiled clothing, bed linen, etc., they should be placed in a tub containing a 1 to 1,000 solution and left for an hour. They can then safely be taken out and rinsed in water and laundered. Bichlorid of mercury, however, is a mordant, and clothing containing stains, such as blood, etc., will be permanently stained if placed in bichlorid solution. Eating utensils should not be placed in bichlorid of mercury on account of the danger from poisoning. Infected floors, tables, wooden beds, chairs, walls, etc., can be washed with a 1 to 1,000 solution of bichlorid of mercury. For applying it, a floor mop may be used. Saturate the floors and other surfaces with the solution and allow them to dry. The hands and body, except the face, can be bathed in a 1 to 1,000 solution without injury thereto.

As already stated, feces, urine, sputum, and products containing albuminous matter should not be disinfected with bichlorid solution unless no other disinfectant is available, in which case a 1 to 500 solution should be used.

"Antiseptic tablets" are usually very soluble in water, and the method of obtaining the desired strengths is stated on the label of the container. They are very useful when only a small quantity of bichlorid solution is required. A 1 to 1,000 solution is easily prepared from them and is very useful for washing the hands after handling the sick or any possible infected material. The hands

should be bathed in the solution for two to five minutes after cleansing them with soap and water.

FORMALIN (SOLUTION OF FORMALDEHYD, U. S. P.).

Formalin, a solution of formaldehyd gas in water, is a valuable disinfectant. It has the advantage of bichlorid of mercury in that its action is not retarded by albuminous matter; it is not corrosive; articles are usually not injured by it; it is a good deodorant; and it is not so highly poisonous as is bichlorid of mercury.

Formalin contains from 35 to 40 per cent of formaldehyd gas, but in referring to percentage strengths the percentage of formalin will be stated and not that of the gas. For instance, a 1 per cent solution of formalin contains formalin in the proportion of 1 to 100, but it contains formaldehyd gas only in the proportion of 1 to 250, provided the formalin contains 40 per cent formaldehyd gas. Therefore, to make a 5 per cent solution of formalin, 1 volume of formalin is added to 19 volumes of water; and to make a 10 per cent solution, 1 volume of formalin is added to 9 volumes of water, etc.

Formalin is well adapted to the disinfection of urine, feces, sputum, and other discharges of like character, for in addition to disinfecting them, it also deodorizes them. For this purpose, according to Anderson,[1] a 5 per cent solution and one hour's exposure is required. They should be thoroughly mixed. Allowance must be made for the dilution caused by mixing the formalin solution with the material to be disinfected. For instance, if 1 pint of feces is to be disinfected it should be mixed with 1 pint of a 10 per cent solution of formalin, or a half pint of a 20 per cent solution, which in each case gives the 5 per cent strength required.

Formalin can not be used in the sick room, as the liberated gas is irritating; nor is it adapted to the washing of floors, walls, etc., for the same reason.

Soiled linen and bed clothing can be disinfected by one hour's immersion in a 5 per cent solution of formalin.

Disinfection with formalin should be done out of doors, in order to avoid the irritating effects of the gas given off.

A few drops either of pure or diluted formalin poured into water-closet bowls, urinals, sinks, etc., destroys offensive odors.

CARBOLIC ACID.

This is a very useful disinfectant. It has a penetrating odor, a strong burning taste, and it is a corrosive poison. Pure carbolic acid

[1] Anderson, John F.: "The antiseptic and germicidal properties of solutions of formaldehyd and their action upon toxins."—Bulletin 39, Hygienic Laboratory, United States Public Health and Marine Hospital Service, Washington, 1907.

crystallizes and becomes solid at ordinary temperature, but it can be liquefied either by heat or by the addition of a small quantity of water, about 5 per cent.

Carbolic acid is soluble in about 15 parts of cold water; that is, 1 ounce of carbolic acid dissolves in 1 pint of water (16 ounces), which is about a 6 per cent solution.

Carbolic acid dissolves in water with some difficulty. Therefore, to insure its solubility, hot water should be used and the mixture well agitated.

For disinfection purposes carbolic acid is commonly used in solutions of 3 to 5 per cent. A 3 per cent solution is made by adding 3 volumes of carbolic acid to 97 volumes of water; a 5 per cent solution is made by adding 5 volumes to 95 volumes of water, etc.

In these strengths carbolic acid is not destructive to fabrics, colors, metals, etc. Therefore, it has a wide range of usefulness in disinfection. As it does not actively coagulate albuminous matter, it is useful for the disinfection of urine, feces, sputum, etc. For this purpose a 5 per cent solution is added to an equal volume of the excretions, the mass then thoroughly mixed and allowed to stand one hour before final disposal.

Soiled linen, bedclothes, etc., are best disinfected by immersion for one hour in a 3 per cent solution, and the same strength solution should be used for mopping floors, walls, etc. After handling the sick or any objects possibly infected, such as bedpans, sputum cups, etc., the hands may be disinfected by washing them for two to five minutes in a 2½ per cent (1 to 40) solution of carbolic acid. The hands should then be washed or saturated with alcohol in order to avoid the benumbing effect of the carbolic acid. As carbolic acid does not kill spores it should not be used to destroy the infection of tetanus, anthrax or malignant œdema.

Crude Carbolic Acid, as sold upon the market, is a black, tarry liquid of very varying composition. It contains cresols and other compounds, but although some of these products have greater germicidal powers than pure phenol (carbolic acid), their solubility in water is so slight that the use of crude carbolic acid as a disinfectant is greatly limited. The reliability of crude carbolic acid is therefore questionable, and some sanitariums recommend that for excreta it be used in the proportion of not less than two volumes of crude carbolic acid (undiluted with water) to each volume of excreta.

Crude carbolic acid has a disagreeable odor, and leaves, after use, a tarry residue, which is objectionable. The crude article, however, is much cheaper than pure carbolic acid, and it is hoped that a simple means of increasing its solubility and of eliminating the objectionable tarry residue following its use, may soon be found, so

that it may at least be employed in the disinfection of urine, feces, sputum, etc.

TRICRESOL.

Tricresol has practically the same uses in disinfection as pure carbolic acid. It differs from it principally in that it is about three times as strong in germicidal powers as is carbolic acid. It, therefore, can be depended upon to kill spores. Tricresol is soluble in water up to about 2½ per cent solution; that is, 1 part of tricresol to 40 parts of water. A 1 to 2 per cent solution used under the same conditions and for the same purposes as already stated for carbolic acid is efficient for all ordinary purposes.

LYSOL AND CREOLIN.

These preparations have practically the same uses in disinfection as carbolic acid and tricresol, and belong to the same general class of disinfectants.

In germicidal strength they rank with tricresol. Their uses are the same as tricresol and carbolic acid which have been stated. They should be used in a 1 to 2 per cent solution.

POTASSIUM PERMANGANATE.

This is a germicide of undoubted power, but of very limited application in general practice on account of the readiness with which it is reduced and rendered inert by organic matter. Except in surgical practice its uses are largely limited to the disinfection of water tanks, cisterns, etc. For this purpose they are emptied of water and the interior thoroughly scrubbed with a 1 per cent aqueous solution of permanganate. After standing an hour or two they are washed out with water until the water comes away perfectly clear. Provided scrubbing of the tanks, etc., is impracticable, they may be filled with water and then enough of a strong solution of permanganate, made with boiling water, added to produce a dark rich purple color. After standing four hours, clean water should be added until the water in the tanks, etc., comes away clear. The tanks are then ready for use. Potassium permanganate is soluble in 16 parts of cold and 2 parts of boiling water. Stains produced by permanganate can be removed by washing in a solution of oxalic acid, lime juice, or vinegar.

LIME.

This substance is also known as quicklime and calcium oxid. It is cheap and when used properly is an efficient disinfectant. Lime may be used for the disinfection of feces, urine, sputum, and other

dejecta; it is useful for the disinfection of privies and for any condition under which the soil is suspected of being infected, as in cellars, mucky back yards, etc.; and it is also useful, when applied as whitewash, for the disinfection and sweetening of cisterns, cellars, barracks, barns, stables, poultry houses, etc.

It is necessary that the lime be obtained fresh and kept in the unslaked condition. As unslaked lime is often in large, stony masses, it should be sufficiently slaked by the addition of a little water to enable its being distributed for disinfection purposes. In then applying it there should be present only enough moisture to cause the slaking to be completed. This necessary moisture is present in urine, feces, sputum, etc., and is usually present in damp cellars, cisterns, privies, dairies, and back yards, it being required only that these localities be liberally sprinkled with the lime. For disinfecting feces, sputum, etc., they should be well mixed with an equal quantity of lime and allowed to stand for an hour or so before final disposal.

Air-slaked lime is practically inert as a disinfectant; therefore, care should be exercised to keep the lime from the air as much as possible before using it.

Milk of lime is a better disinfectant than lime. It is made by mixing, in a tub or bucket, fresh lime with four times its volume of water, the resulting mixture being ready for use. It is useful for disinfecting excreta, etc., to which it should be added in equal volume and allowed to stand for two hours before final disposal. Milk of lime is most powerful when first prepared. It therefore should be made and used fresh, unless it can be bottled or in some way protected from the air after it is prepared.

CHLORINATED LIME.

Chlorinated lime, or bleaching powder, popularly miscalled "chlorid of lime," according to Rosenau,[1] ranks with unslaked lime in power and value as a germicide, and has about the same uses in practical disinfection. It is a much better deodorant than lime.

As chlorinated lime deteriorates on exposure to the air, through the liberation of its chlorin, it should be kept in air-tight containers and preferably stored in a cool, dry place.

For disinfection purposes it may be used either as a powder or in solution. As a powder, it is applied in very much the same manner as lime. Cellars, privies, etc., are simply sprinkled with it, but not so liberally as when lime is used. It should be well mixed with urine, feces, sputum, etc., in sufficient quantity to form about 4 per cent of the entire mass.

[1] Rosenau, M. J.: "Disinfection and disinfectants," 1902, p. 167.

Small quantities of chlorinated lime sprinkled in sinks, urinals, water-closet bowls, etc., will destroy foul odors.

By mixing 1 pound of good chlorinated lime with 4 gallons of water a *solution of chlorinated lime* is obtained which is very useful for disinfection purposes. With this solution floors may be mopped and the hands disinfected by washing them in it for a few minutes. Excreta and sputum are disinfected by thoroughly mixing them with equal volumes of this solution and allowing to stand for one hour.

Chlorinated lime corrodes metals, but the injury to agate ware, such as bedpans, is only slight. It bleaches and otherwise injures fabrics. The disagreeable odor resulting from the use of chlorinated lime in the sick room may be removed by hanging about in the room towels saturated with a strong solution of baking soda.

THE HYPOCHLORITES OF LIME.

As the active disinfection agent found in solutions of chlorinated lime is principally calcium hypochlorite, the uses of the hypochlorites are practically the same as the solution of chlorinated lime.

Labarraque's solution is an aqueous solution of several chlorin compounds of sodium, chiefly sodium hypochlorite and sodium chlorid.

It may be diluted with twice its volume of water and used for the same purposes and in the same manner as the solution of chlorinated lime.

PART II.

INSECTICIDES.

An insecticide is a substance that destroys insect life.

There are many ways and methods of doing this, but only the simple methods of using the common insecticides, as applied to disinfection against the insect-borne diseases, will be dealt with here.

Attention will therefore be paid principally to the destruction of flies, fleas, mosquitoes, roaches, bedbugs, lice, rats, mice, etc. The destruction of insect life and disinfection are often accomplished simultaneously in the process of disinfection, as most germicides are also insecticides, a notable exception to this being formaldehyd gas, which, although a good germicide, has little or no effect upon insect life. Therefore, in using gaseous germicides (disinfectants) as insecticides, they are applied in much the same manner when used for the latter as for the former purpose.

However, when using them for the destruction of insect life only they are usually used in a weaker strength and for a shorter time of exposure than when they are used for their germicidal effect.

In using gaseous insecticides every care should be exercised to avoid the escape of the insects from the enclosure during the process of killing them; consequently all points of possible exit should be closed. Closets, bookcases, drawers, etc., likely to harbor or contain them, should be opened to allow access of the gas.

The following insecticides will be considered:

(1) Sulphur.
(2) Hydrocyanic acid gas.
(3) Pyrethrum.
(4) Petroleum.

SULPHUR.

Sulphur is one of the most valuable and efficient insecticides that we possess. It may be used in several forms.

SULPHUR DIOXID.

The methods of producing this gas have already been described, therefore further description here will consist only of the differences between its uses and applications as an insecticide and those as a germicide.

As an insecticide sulphur does not require the presence of moisture, since it acts equally as well in a dry as in a moist atmosphere. Therefore, moisture should not be artificially produced, as the drier the atmosphere the less the injury there will be to furnishings, colors, etc.

With all cracks and crevices closed to prevent their exit, a 1 per cent strength will kill flies and mosquitoes within two hours; and if the atmosphere is reasonably dry, very little injury will be done to the ordinary room furnishings.

A 2 per cent strength will kill rats within four hours, and a 5 per cent strength will destroy most bedbugs, roaches, lice, etc., within six hours, although some of these insects usually escape by seeking protection in crevices, etc. To obtain the desired strength of sulphur gas it is only necessary to remember that the burning of 1 pound of sulphur in 1,000 cubic feet of space produces approximately 1 per cent of the gas, 2 pounds 2 per cent, etc.

The pot method of production has already been described. In order to burn the sulphur quickly it should not be placed in the pots to a greater depth than an inch. Water pans are not required, but the pots should be placed upon bricks, sand, stones, or something of that nature as a protection against fire. The pots are arranged and lighted with alcohol as has been described.

Liquid sulphur dioxid is well adapted to the destruction of insect and vermin life, as the gas is liberated in a short time. Two pounds of the liquid are equivalent to 1 pound of sulphur when burnt by the pot method. The method of liberating the gas has been described.

Sulphur candles are sometimes useful for killing flies and mosquitoes, or where only a small percentage of the gas is required. Candles vary in weight, but their weight should be determined, and for killing flies and mosquitoes not less than 1½ pounds of candle should be used for each 1,000 cubic feet. The candles require only to be placed upon bricks and lighted; they usually burn easily. The usual time of exposure, two hours, is required.

FLOWERS OF SULPHUR.

Sulphur in the powdered state may be used as an insecticide, but it must be directly applied to the insects, and is used principally for the destruction of mites, lice, etc. It has but a limited use against bedbugs, ants, roaches, etc., and is useless against the winged insects.

BISULPHID OF LIME.

This is a good insecticide where a liquid is applicable. According to Rosenau [1] it may be very cheaply prepared by boiling together for an hour or more, in a small quantity of water, equal parts of flowers of sulphur and stone lime. A convenient quantity is pre-

[1] Rosenau, M. J.: "Disinfection and disinfectants," 1902, p. 185.

pared by taking 5 pounds of sulphur and 5 pounds of lime and boiling in 3 or 4 gallons of water until the ingredients form a brownish liquid. This may be diluted to make 100 gallons. It is applied in the form of a spray or poured into cracks and crevices infested with bedbugs, lice, roaches, etc.

HYDROCYANIC ACID GAS.

This gas is very poisonous to all forms of animal life. It kills rats, mice, roaches, flies, fleas, mosquitoes, and bedbugs with great certainty and very quickly. In the hands of the inexperienced it is a very dangerous gas, as the least carelessness with it may result in the loss of human life, since it is deadly poisonous. It is therefore unsafe and unwise to use it in inhabited buildings, but it is useful for destroying all forms of vermin in granaries, stables, barns, poultry houses, etc. For this purpose it is used in the following quantities and proportions for each 1,000 cubic feet of air space:

Potassium cyanid	1 pound.
Sulphuric acid	1.5 pints.
Water	2.25 pints.

The acid and water are first mixed in an earthen vessel that will withstand heat, as this mixture gets very hot. The cyanid should not be added to it until the liquid has become cool. The required quantity of cyanid should be weighed and put into a gauze bag, and when everything is in readiness the bag is placed in the liquid contained in the vessel. The acid destroys the bag and acts on the cyanid with rapid evolution of the gas; and as the gas is deadly poisonous, the operator must leave the room at once.

A still safer method of adding the cyanid to the acid than the one just stated is to have the bag of cyanid supended over the acid by means of a string leading to the door of exit, from which location it can be lowered into the acid when desired. In this manner one or more processes can be set off without danger to the operator.

The inclosure should be made as tight as possible to avoid the escape of the gas. The time of exposure should be six hours, though a longer time will minimize the danger from the gas in opening the doors and windows. It should be arranged before starting the process, so that the windows and doors can be opened from the outside, and it is best to hold the breath while actually opening a door or window. Under no condition should the building be entered until it has been aired out from 8 to 10 hours.

PYRETHRUM.

Pyrethrum is only a fairly good insecticide. It is not poisonous to man, nor are household furnishings of any kind injured by it. Unfortunately, it is not very powerful for the destruction of roaches.

flies, fleas, and mosquitoes. Some of these insects are killed, while some are only stupefied, by pyrethrum, so that it is necessary, after using it, to sweep the insects up and burn them.

Pyrethrum may be used either in powdered form or as the fumes resulting from burning it. Persian and other insect powders sold upon the market usually contain pyrethrum in some form. As a powder it may be blown about in the closed room with a bellows in sufficient quantity to show perceptibly upon the floor, or it may be dusted into cracks, crevices, dark corners, closets, or special localities likely to be infested with mosquitoes, fleas, bedbugs, etc. After two hours' exposure the insects should, when practicable, be swept up and burned.

In burning pyrethrum for killing flies and mosquitoes the room should be closed as tightly as possible. In killing these insects in dwellings it is well to pull down all window shades except one, as the insects will then go toward the light of the window the shade of which is not drawn, and when they die or become stupefied they can be easily swept up. Pasting of door and window cracks is usually unnecessary.

From 2 to 4 pounds of pyrethrum should be burned for every 1,000 cubic feet. The pyrethrum is burned in pots, pans, or iron buckets in the same manner that sulphur is burned in the pot method. The pots should be used in sufficient numbers so that not more than 4 pounds of pyrethrum will have to be placed in each pot. They should be distributed about in the room upon metal or stone foundations in order to guard against fire.

The pyrethrum is started burning by sprinkling it with alcohol and lighting it. After the alcohol has burnt, the pyrethrum smolders and burns, thus liberating the fumes.

The time of exposure is usually 2 hours, although when working at night the quarters may be left closed until the following morning. As stated, the insects should be swept up and burned as soon as the quarters are opened. Both the fumes and the powdered form of pyrethrum are harmless to man, so there is no danger in entering quarters as soon as they are opened.

PETROLEUM.

Petroleum is also known as kerosene, coal oil, lamp oil, etc.

It is a valuable insecticide but of limited application, as it must be applied in liquid form. Its principal use as an insecticide is in the extermination of mosquitoes. As is well known, mosquitoes usually breed in standing water, such as pools, ponds, puddles, cisterns, rain barrels, etc. The female mosquito lights and lays her eggs upon the water, the eggs hatch, and the young mosquitoes then

live in the water in the form of "wrigglers" until they reach maturity. It is necessary for "wrigglers" to come to the surface of the water every few minutes to breathe; therefore with even a thin film of petroleum upon the water the oil gets into their breathing apparatus and kills them. Likewise the female mosquito is usually killed when she lights in the film of oil to lay her eggs. Mosquitoes breed only in water; they do not breed in wet grass, manure, etc., unless there is sufficient water upon which the eggs may float and in which the "wrigglers" can swim. Therefore to stop the breeding of mosquitoes it is necessary only to cover the water with a thin film of petroleum. When petroleum is poured into water it spreads and forms a thin film over the surface. It is applied at the rate of 1 ounce of petroleum to 15 square feet of water surface. It should be renewed at least once a week or oftener, depending upon conditions which are apparent in any given case.

By having the outlet for water in barrels, cisterns, ponds, etc., below the surface the running away of the oil may be prevented, and water obtained for use free from oil. Petroleum is also useful against roaches, bedbugs, and other forms of insect vermin. For this purpose the pure oil may be directly applied, or it may be used in the form of a spray.

Gasoline is a very useful and efficient insecticide for bedbugs and lice. In the liquid form it can be liberally poured into the cracks and crevices of beds, floors, walls, chairs, etc., infested with these insects. Even when gasoline is poured upon a papered wall it soon evaporates without injury to the paper. The strictest precautions, however, must be taken against fire, as gasoline is highly inflammable. Therefore the presence of fire or the lighting of a match in the vicinity where gasoline is being used, must be prohibited.

PART III.

THE APPLICATION AND USE OF DISINFECTANTS AND INSECTICIDES IN THE ERADICATION AND PREVENTION OF COMMUNICABLE DISEASES.

There are already a large number of diseases known to be communicable, and the list is still increasing as time goes on and new discoveries are made.

As communicable diseases are preventable, this, then, is the day of preventive medicine, and a large share of the responsibility naturally falls upon the medical profession, particularly the health authorities. Their work, however, would be very much handicapped and often go for naught without the aid of the general public; therefore it must do its part, and its part is no small one.

A knowledge of medicine is not always necessary in order to conform to the simple rules of hygiene and intelligently to apply the use of disinfectants in the prevention of communicable diseases. "Communicable," "infectious," and "contagious" are terms that have become more or less synonymous in their meaning, and are often used interchangeably to convey the same idea in referring to the transmission of disease.

A thorough understanding—which at present is lacking—as to the exact nature of the cause and methods of transmission of some of the communicable diseases might make it possible to inaugurate for their prevention more effective and probably simpler methods than those at present in use.

In the case of many of the communicable diseases, however, the specific organism is known and its modes of transmission are understood; with others the specific germ is known, but its modes of transmission are not at all or only poorly understood; with others the organism has not been identified, but its modes of transmission are at least fairly well understood; while with still others the specific organism or cause is still unknown and its ways of transmission are only vaguely understood. Furthermore, some of the communicable diseases are transmitted through the agency of insects acting as simple carriers of the infection; others through insects as intermediate hosts; and others through food, drink, contamination of the air, contact, and various other ways.

It is evident that the uses and application of disinfectants and insecticides in the prevention of all the communicable diseases is a large subject, and to take up each disease in detail would reach far beyond the limits of this article. Therefore, as some diseases call for the same general hygienic management and preventive measures, the one most typical of the class will be described, and the remaining ones of that class described only in so far as they may differ from the one described as typical. For instance, the prophylactic measures that should be carried out against typhoid fever are very much like those that should be used against cholera, dysentery, etc., and, therefore, typhoid will be taken as typical of the class; likewise smallpox will be described as typical of the exanthemata, others of which are scarlet fever, measles, chicken pox, etc.

It should be borne in mind that, after all, disinfection is a more or less relative process and that it can but seldom be made absolute, particularly in so far as the infection of the communicable diseases is concerned. Patients suffering with some of the communicable diseases are constantly eliminating the infection from their systems and to disinfect all the infection thus eliminated is well nigh impossible. Nevertheless, most of it can be destroyed by the intelligent use of disinfectants, thus reducing to a minimum the danger of the infection being spread.

(1) TYPHOID FEVER—CHOLERA—DYSENTERY.

TYPHOID FEVER.

Typhoid fever is a communicable disease caused by the *Bacillus typhosus*, a germ so small that it can not be seen except with a microscope.

The germs are contained in enormous numbers in the feces, usually in the urine, and often in the sputum of typhoid patients. Typhoid fever is always contracted by taking these germs into the body, through the mouth, either with the food, drink, or otherwise.

A small particle of typhoid excreta, even what will adhere to the legs of a fly, may contain the typhoid organism in large numbers. It is easy then to understand how flies and other insects may spread typhoid infection. They light upon the feces, urine, sputum, or even the lips of the patient; they then may infect food and drink by lighting upon it, or they may carry the infection direct to healthy persons.

The fly, therefore, should be rigidly excluded from the sickroom and from the whole house if possible by screening; fly paper or fly poison should be exposed in the sickroom to kill any that may by chance gain entrance thereto. During certain seasons of the year

the fly may not be present, but under no condition should excreta of typhoid patients be exposed to flies, at least until it has been thoroughly disinfected. The disinfection should, therefore, be done in a fly-proof inclosure.

The sickroom should have a bare floor, so that it may be washed with a disinfectant from time to time and whenever it may be soiled with the patient's excretions; unnecessary furniture should be excluded from the room; a basin containing a 1 to 40 solution of carbolic acid or a 1 to 1,000 solution of mercuric chlorid should be in readiness for the doctor's and nurse's hands. A cup or glass containing a 1 to 40 solution of carbolic acid for the thermometer should be on hand, and the thermometer should be kept entirely submerged in the solution when not in use; one or more bedpans should be available, and there should be on hand a supply of disinfectants, as well as some buckets or vessels in which to prepare the disinfectant solutions.

Special gowns for those attending the patient may be used, but they are not necessary, provided intelligent care is exercised. The nurse, however, should wear a rubber apron when bathing the patient, and it should be frequently washed in 3 per cent carbolic acid. Visitors and others not required in the sick room should be excluded.

Disinfection and disposal of excreta.—Feces, urine, sputum, and all discharges from a typhoid fever patient should be disinfected as soon as they leave the patient.

This is economically and efficiently accomplished by having a jar, bucket, or pan large enough to hold several times the volume of the excretions voided in 24 hours. It is placed convenient to, but not in the sick room, and not accessible to flies. The urine, feces, etc., are placed in it when they are voided, and a volume, equal to, or greater than the volume of excretions, added to it of one of the following solutions:

Solution of chlorinated lime (p. 23).

Milk of lime (p. 22).

Solution of carbolic acid, 5 per cent.

Solution of formalin, 10 per cent.

The bedpan is rinsed with the disinfectant solution and it then should be immersed for 10 minutes in one of the above solutions, contained in a suitable vessel, as it must be remembered that the outside of the bedpan may be infected by coming in contact with the patient. Bedpans may also be disinfected by sprinkling them with a strong solution of formalin and then simply covering them with a heavy cloth for 15 to 20 minutes. On account of the formaldehyd gas given off this will have to be done out of doors.

In the above manner the entire excretions of a patient for a day can be disinfected and disposed of in sewers, water-closets, privies, etc., without danger of spreading the infection.

Chlorinated lime (powdered form), if used for disinfecting excreta, should be thoroughly mixed with the excretions in sufficient quantity to form 4 or 5 per cent of the entire mass. Likewise, lime used for the same purpose should be added in volume equal to that of the excretions.

When it is impracticable to disinfect the excretions for 24 hours, as stated above, bear in mind that excretions from typhoid patients should not be finally disposed of until they have been exposed to the action of the disinfectant for at least one hour, and under no condition should the excretions be disposed of without disinfection.

The typhoid germ is rather easily killed by heat; therefore in rural districts when disinfectants are not available or only in very small quantities, typhoid excreta can be disinfected with boiling water. In this case the excretions may be sufficiently disinfected to render them safe by filling the bedpan containing the excretions with actually boiling water and allowing it to stand until cool; the contents of the pan are then disposed of, preferably by burying, and the pan rinsed (scalded) with boiling water. Of course the excretions may be disinfected by boiling them in a vessel located in the back yard or some other suitable place. The bedpan though, after it is emptied, should be placed in boiling water for a few minutes.

The preventive measures outlined above should be kept in force, with regard to the urine and feces of typhoid patients, for two or three weeks after recovery, as these excretions may contain the typhoid organism for a considerable time after convalescence. Typhoid excretions should *never* be disposed of where they may get into the water supply, even though they have been disinfected.

Disinfection of the hands.—After handling the patient, bedpan, soiled linen, or any possibly infected material, the hands should be washed for at least two minutes in one of the following solutions:

Bichlorid of mercury	1 to 1,000
Carbolic acid	1 to 40
Tricresol	1 to 100
Lysol	1 to 100

After washing the hands in any one of the last three solutions they should be rinsed in alcohol to avoid the benumbing effect of these solutions. Persons engaged in handling and managing typhoid-fever patients should avoid, as far as possible, placing their hands about their own faces, and they should invariably wash their hands in one of the above disinfectant solutions before eating their meals.

Disinfection of soiled linen, bed clothing, eating utensils, etc.—Soiled linen, towels, bedclothes, etc., are best disinfected by boiling

them for a few minutes. They may also be disinfected by one hour's immersion in a 3 per cent solution of carbolic acid or a 1 per cent solution of tricresol, etc.

Eating and drinking utensils, after being used by the patient, should be washed in boiling water. They should not be used by others, at least until they have been sterilized by boiling.

Disinfection of the bath water.—The water used in bathing the patient may undoubtedly be infected by the patient's excretions. The ordinary bath of 50 gallons of water may be disinfected by mixing in it half a pound of chlorinated lime and allowing it to stand for half an hour before disposing of it.

Terminal disinfection.—Gaseous disinfection of the room after convalescence, death, or removal of the patient is not always necessary, but it is advised as a measure of safety against any possible infection that otherwise might escape disinfection. It is therefore recommended that formaldehyd gas be used, as described on page 9.

The floor, walls, tables, bed, chairs, etc., should be washed with a disinfectant solution, particularly if gaseous disinfection is omitted. The bed clothing, pillows, linen, etc., should be treated as already described. Without the use of a steam chamber the disinfection of mattresses is a difficult and uncertain problem. Therefore, it is far better that they be burned.

It may be well to state here that during the prevalence of typhoid fever in a house or community it is well to drink only boiled water, and either to avoid drinking milk or drink it only after it has been heated to the boiling point.

Bear in mind, then, that the watchword in typhoid-fever prevention is to *disinfect the excretions as they leave the patient, and to avoid taking living typhoid germs into the body in the food, drink, or otherwise, for without taking these germs into the body through the mouth there will be no typhoid fever.*

CHOLERA.

Cholera is a communicable disease due to the *Vibrio choleræ asiaticæ* or, as it is often called, the "comma bacillus." The disease is sometimes called Asiatic cholera, on account of its home in India, and to distinguish it from cholera nostras, cholera morbus, and other forms of noncommunicable affections with choleraic symptoms.

The feces always, and the vomit frequently, of those having the disease contain the germ in great numbers. They, however, are not found in the urine.

The germs are conveyed from sick to healthy persons and the disease thus contracted in almost the identical way as is typhoid

fever. The reader is therefore referred to the description of typhoid fever given above for the details of disinfection and other preventive measures to be carried out against cholera.

DYSENTERY.

Dysentery is a communicable disease occurring in epidemic form, especially in the tropics or during the hot season of the year. It is sometimes called "epidemic dysentery" to distinguish it from "amebic dysentery." Dysentery is caused by the *Bacillus dysenteriæ*, a minute bacterial organism, while amebic dysentery is believed to be due to the *Entamœba histolytica*, an organism belonging to the animal kingdom and rather resembling in appearance a white blood cell. The former, then, is due to a bacterium, the latter to a protozoon. The two diseases, however, are contracted in very much the same manner, namely, by taking the organisms into the body through the mouth, usually with the food and drink.

The feces of patients having either one of these diseases contains the specific organism in large numbers. Therefore what has been stated with regard to the prevention of typhoid fever applies also to the prevention of both dysentery and amebic dysentery.

(2) SMALLPOX—SCARLET FEVER—MEASLES—CHICKEN POX—ERYSIPELAS.

SMALLPOX.

Smallpox is highly communicable, but the cause of the disease has not been discovered. The disease is often referred to as "contagious" because it is readily conveyed by contact between the sick and the well. The exact manner in which the virus of infection of smallpox is given off from the body of the patient is not definitely known, but it is thought to be thrown off from the body of the patient into the surrounding air, perhaps with the exhaled breath and certainly from the eruption, whether fluid or dried in the crusts.

The infection of smallpox is thought to enter the body through the respiratory tract.

The preventive measures to be carried out against smallpox are, briefly stated, *vaccination*, *isolation*, and *disinfection*.

Vaccination.—All persons should be vaccinated at least by the time they are a year old. If the vaccination does not "take" it should be repeated until it does "take." They should be vaccinated again about every five years or whenever they are exposed to smallpox. Persons continuously exposed to smallpox should be vaccinated at least once a year.

Isolation.—Whenever possible, smallpox should be treated in an isolation hospital provided for contagious diseases. Where this is not practicable, a room should be used that is isolated as much as

possible from the remainder of the building. The room, before being occupied by the patient, should be divested of all unnecessary furniture, hangings, draperies, carpets, etc. It should be capable of being darkened and freely ventilated. An adjoining room should be available for the use of the doctor and nurses, as well as for disinfection and other obvious purposes. There should be no communication with the patient except on the part of the necessary attendants, nurses, and the physician.

Disinfection.—Body clothing worn by the patient before taking to bed should be boiled or burned. All linen, garments, towels, etc., soiled or used by the patient should, as soon as they leave the patient, be immersed at least one hour in one of the following solutions:

Carbolic acid	5 per cent.
Tricresol or lysol	1 to 2 per cent.
Chlorinated lime	4 ounces to 1 gallon of water.

As a further measure of safety they should then be boiled, after which they may be laundered and again used, if desired.

Handkerchiefs or clothes soiled by secretions from the patient's nose and mouth had better be burned, though they may be disinfected, as stated above.

The urine and feces of smallpox patients are not supposed to contain the virus of smallpox, but since they may become infected either during or after they are passed by the patient they should be disinfected before disposing of them. They may be disinfected in any one of the ways described for the disinfection of typhoid excreta.

Eating utensils, medicine glasses, etc., used by the patient should be immersed in actually boiling water. Food that has been in the sick room, but not consumed, should either be burned or placed in boiling water. All disinfection should, as far as possible, be done in a room adjoining the sickroom; or, if that is not available, in the sickroom. The doctor or others temporarily entering the sickroom should wear gowns provided for the purpose.

The nurse should wear dresses of material not injured by disinfectants, for these garments, as well as the doctor's gowns, should be disinfected.

The physician, nurses, etc., after being with the patient, should change their clothing before mingling with other persons. After handling the patient or any possibly infected material, the hands of the operator should be washed for a few minutes in carbolic acid solution 1 to 40, bichlorid of mercury 1 to 1,000, or some other disinfectant solution. The floor of the sickroom should occasionally be dampened with one of these solutions.

In cleaning the sickroom the raising of dust should be guarded against by using a damp cloth or mop for the purpose, or by dampening the floor before sweeping it.

By applying a bland oil, such as vaseline, to the surface of the skin of the patient during the stage of desquamation, the dissemination of the exfoliated particles of skin, crusts, etc., may be largely prevented.

Remember that smallpox is infective during the entire period of desquamation and that the patient should be treated accordingly. When the patient is able to be up and desquamation is fairly well along the body of the patient may be sponged daily with a 1 to 2,000 solution of bichlorid of mercury. The patient should then occupy another room, at least until the original sickroom can be disinfected. To do this, everything in the room should be left *in situ* and formaldehyd gas applied by one of the methods already described, preferably by the formalin-permanganate method. In rural districts where formalin is not available sulphur dioxid (pot method) may be used as described on page 15. Sulphur dioxid, however, is rather difficult to confine to one room.

After the gaseous disinfection is completed the floor, tables, chairs, etc., should be washed with a 3 per cent solution of carbolic acid or some other disinfectant solution. The mattress should be burned and the bed linen, garments, and other articles in the room disinfected, as has already been stated.

Any room that may be occupied by the patient during the stage of desquamation should, when vacated, be disinfected in accordance with the rules that have been outlined above.

When the stage of desquamation is entirely over—that is, when the skin is smooth and scales or particles of skin are no longer being given off, even from the pocks of the scalp—the entire house should be disinfected with formaldehyd gas.

After the disinfection is over the room last occupied by the patient should be further treated, as has been stated.

Of course, if the patient dies or is sent to a hospital, the room and entire house from which the patient is removed should be thoroughly disinfected in accordance with the rules outlined to be carried out after the patient's recovery.

SCARLET FEVER.

Scarlet fever is a highly communicable disease, but the nature of the specific organism or cause is not yet known. The infection is likely contained in the secretions of the nose and mouth, and certainly in the exfoliated particles of skin. Desquamation is often so extensive in this disease that it amounts almost to a complete peeling of the outer layers of the skin. The infection seems to live more or less indefinitely in the exfoliated particles of skin, and the disease is often in this way conveyed from the sick to healthy persons.

Scarlet fever is very analogous to smallpox from the standpoint of conveyance, prophylaxis, etc. Therefore, omitting the subject of vaccination, what has been outlined with regard to preventive measures, management, disinfection, etc., for smallpox apply almost equally well to scarlet fever. The reader is consequently referred to the subject of smallpox for many of the details omitted here.

The patient should be isolated in a similar manner and the same precautions taken as have been stated for smallpox. All soiled linen, towels, bedclothes, etc., eating utensils, urine, feces, sputum, and nasal secretions should be disinfected; and the same care of the hands and of the floor, the same precautions as to the doctor's gowns and the nurse's wearing apparel should be taken as have been already outlined above for smallpox.

Remember that it is during the desquamatory or peeling stage of scarlet fever that the disease is most dangerously communicable, and that this condition exists until the stage of desquamation is entirely completed. During this stage the body of the patient should be daily sponged with a 1 to 100 carbolic or a 1 to 2,000 bichlorid solution. In children, however, the use of carbolic acid solution is not entirely free from danger.

Disinfection of the room, bedding, etc., during the stage of desquamation, and disinfection of the entire building, room, and bedding, etc., after desquamation is over should be carried out as in the case of smallpox.

The floor of the sickroom should not be swept in a manner that will raise the dust, as the infection may thus be spread. Either dampen the floor or use a damp mop or cloth for cleaning it.

MEASLES.

Measles is a communicable disease the cause of which is unknown. It usually occurs in epidemic form. The infection is present in the secretions and in the skin, and there seems to be no doubt but that it is present in the secretions of the nose and mouth very early in the disease.

Direct contagion is common, but dried particles of skin, sputum, and nasal secretion containing the infection may be conveyed in dust, clothing, etc., and thus spread the disease. Measles is, therefore, spread in very much the same manner as smallpox and scarlet fever. Consequently the disinfection for measles is the same as that described for smallpox, to which the reader is referred.

Attention is called to the fact that measles being a very common disease, it is not often deemed necessary to take the precautions of isolation and disinfection for measles that are taken for smallpox

and scarlet fever; but it should be borne in mind that in the United States measles causes more than twice the number of deaths caused by smallpox in the same length of time.

CHICKEN POX.

The cause of chicken pox is unknown, but it is undoubtedly due to a specific infection.

The disease is highly "contagious" in the same sense that smallpox is, viz, by contact between the sick and the well. The disease is spread in much the same way and through about the same channels that smallpox spreads, and therefore the same disinfection measures that apply to smallpox apply also to chicken pox.

ERYSIPELAS.

Erysipelas is communicable and is caused by the *Streptococcus erysipelatis*. The organism is contained in the pus and secretions from the seat of the inflammation, and also in the desquamating skin of those suffering with erysipelas.

It is not definitely known how the infection enters the system, but probably it is through the abraded skin or mucous membranes; at least, persons with wounds or abrasions of the skin are very susceptible to infection with erysipelas.

Patients suffering with erysipelas should be isolated and the disinfection measures for erysipelas carried out along the same general lines as have already been prescribed for scarlet fever.

(3) DIPHTHERIA—EPIDEMIC CEREBROSPINAL MENINGITIS—ACUTE ANTERIOR POLIOMYELITIS—INFLUENZA—PNEUMONIA.

DIPHTHERIA.

Diphtheria is a communicable disease caused by the *Bacillus diphtheriæ*. The germ is found in the secretions of the mouth, nose, and throat, and in the membrane from the site of the lesion in diphtheria. It may sometimes be found in the throats of persons showing no signs of the disease. It is not found in the air unless particles of secretions, membranes, etc., after drying, are blown about with the dust. The infection may be directly communicated from mouth to mouth by kissing, coughing, etc., or indirectly by objects that have become contaminated with the germs of the disease. It may also be spread by food, especially milk.

The uses of antitoxin in the prophylaxis and treatment of diphtheria will not be discussed.

Isolation.—Isolation of diphtheria should be carried out as prescribed for smallpox.

Disinfection.—The germ being contained in the secretions of the nose, mouth, and throat, it is obvious that these secretions should be disinfected as soon as eliminated, and that cloths, handkerchiefs, etc., used to receive them should be disinfected or burned. Bed and body linen of the patient, when removed or soiled, should be immersed for one hour in one of the following solutions: Carbolic acid, 5 per cent; formalin, 5 per cent; and tricresol or lysol, 2 per cent. The immersion in the formalin solution can not be done in the sick room. Eating utensils, medicine glasses, etc., used by the patient should be disinfected in boiling water. The thermometer, except when in use, should be kept in a 3 per cent solution of carbolic acid. Brushes, swabs, etc., used about the patient's mouth should, when not in use, be kept in a weak (1 per cent) carbolic acid solution, and when no longer required they should be burned.

Before disposing of feces or urine, they should have added to them, and allowed to stand for at least an hour, an equal volume of one of the following: A 5 per cent solution of carbolic acid, or a solution of chlorinated lime, 4 ounces to the gallon of water.

The hands of attendants, after handling the patient or any material connected therewith, should be washed in a 1 to 40 solution of carbolic acid or a 1 to 1,000 solution of bichlorid of mercury.

Upon convalescence of the patient the entire house should be disinfected with formaldehyd gas, preferably by the formalin-permanganate method. The room in which the patient was sick should then be washed with a disinfectant solution, the mattress burned, and the bedding, etc., either disinfected as described above or boiled or burned.

The *Bacillus diphtheriæ* often exists in the throat for some time after convalescence; therefore, the patient should be kept isolated until bacteriological examinations no longer show the presence of the diphtheria organisms in the throat.

EPIDEMIC CEREBROSPINAL MENINGITIS.

This is a communicable disease caused by the *Diplococcus intracellularis meningitidis.* The organism is found in the cerebrospinal fluid and in the nasal secretions. It is possible that it is sometimes contained in the sputum, urine, and feces.

The methods of conveyance of epidemic cerebrospinal meningitis are not yet definitely settled, but it seems very likely that it and diphtheria are communicated in very much the same way. The measures of isolation, disinfection, etc., prescribed above for diphtheria apply and should be enforced against meningitis.

ACUTE ANTERIOR POLIOMYELITIS.

This disease is also known as "epidemic poliomyelitis" and "infantile paralysis." The cause of the disease is unknown, and it has only recently been definitely proven to be a communicable disease. It may occur in epidemic form. The infection is undoubtedly contained in the nasal secretion and probably in the sputum, urine, and feces of those having the disease.

The way in which the infection is communicated from sick to healthy persons is not well established, but it probably takes place in much the same manner as in the case of diphtheria and epidemic cerebrospinal meningitis; and therefore the same preventive measures should be rigidly carried out against it that have been prescribed for the two latter-named diseases.

INFLUENZA.

Influenza is a highly communicable disease, occurring in widespread epidemics and caused by the *Bacillus influenzæ*. The organism is found in great numbers in the secretions of the nose and mouth of those suffering with the disease. The preventive measures for influenza should be carried out along the same lines as those prescribed for diphtheria.

PNEUMONIA.

Pneumonia, croupous or lobar pneumonia, is a communicable disease. It is caused by the *Diplococcus pneumoniæ*. The organism is widespread and is often found in the sputum of healthy persons. The sputum and nasal secretions of those suffering with the disease contain the organism in enormous numbers. It is therefore obvious that the disease may be communicated in very much the same way that diphtheria is communicated, and that, from a prophylactic standpoint, it should be handled accordingly.

(4) TUBERCULOSIS—LEPROSY.

TUBERCULOSIS.

Tuberculosis is a communicable disease prevalent in all parts of the world.

It is caused by the *Bacillus tuberculosis*, a very minute organism or bacterium. Tuberculosis may affect any part of the human body, although the lungs and respiratory tract are the parts most frequently affected, in which case the disease is often called "pulmonary tuberculosis," "consumption," etc. This is the variety of the disease that is the most dangerously communicable and therefore the one that will be especially considered here.

The bacillus of tuberculosis is usually contained in the sputum of consumptives in large numbers. It is very often contained in the nasal secretion and feces and sometimes in the urine. The germs of tuberculosis outside the body are long-lived and resistant to destruction. It is obvious, then, that the germs may be scattered far and wide by the constant coughing and spitting attending consumption. The dried secretions containing the organisms may mix with the air and dust and thus be inhaled into the lungs of healthy persons.

The germs may also be communicated in many other ways, as, for instance, in the common use by healthy persons and consumptives of drinking cups or glasses, towels, tableware, soap, eating utensils, beds, berths, etc.; from mouth to mouth by kissing or coughing; through the food, especially milk and meat from tuberculous animals; and by the association or living of healthy persons with consumptives. It is largely by means of the sputum in the moist condition that a consumptive infects another person.

Isolation.—A consumptive should be isolated, though not necessarily in the strict meaning of the term as applied to smallpox or scarlet fever. The patient should sleep alone, whether it be in a room, a tent, or in the open. If a room is used, it should be one that is isolated as much as possible from the remainder of the building. It should preferably be on the sunny side of the house and well ventilated. Consumptives that are able to be up and around should spend their time, as far as possible, in the open air, but when indoors they should occupy their own rooms. The consumptive's room should be frequented only by those having duties to perform therein.

Disinfection.—Be careful to *destroy all the sputum of consumptives.*

The germ of tuberculosis is easily killed by heat, but it is rather difficult to kill it with chemical disinfectants, especially when it is incorporated with sputum. Therefore the sputum from a consumptive should, as far as possible, either be burned or boiled.

Portable spit cups that are destructible and cheap should be used by consumptives, and after a cup has been in use a few hours it should be burned. If indestructible cups are used, they should contain, while in use, a small quantity of a 5 per cent solution of carbolic acid or a solution of chlorinated lime, and they should be disinfected each day by boiling them and their contents in water. The same measures should be carried out with regard to spittoons, whether they are used by the consumptive or by the public. The spitting in public spittoons by consumptives should be prohibited, but as a matter of fact it often occurs. Consumptives should expectorate only into their own private cups or into the fire. During the act of coughing consumptives should hold a handkerchief before the mouth in order to catch the particles of sputum expelled.

Napkins, handkerchiefs, clothes, etc., used by consumptives should be disinfected in boiling water. Eating utensils, drinking cups, medicine glasses, etc., should also be disinfected in actually boiling water, and under no conditions should they be used by healthy persons until they have been disinfected. Consumptives should never use public drinking cups.

Bed and body linen removed or soiled by the consumptive should be placed directly into a kettle of water and boiled; if this is not practicable at the time of removal they should be placed in a 5 per cent solution of carbolic acid or a 2 per cent solution of tricresol or lysol until such time as they can be boiled.

As the feces of consumptives usually contain the germs of tuberculosis in large numbers, the fecal discharges of consumptives should be disinfected in accordance with the same general rules as have been prescribed for the stools in typhoid fever.

The floor of a consumptive's room should occasionally be mopped with a disinfectant solution. The floor should *never* be swept without guarding against the raising of dust; either dampen the floor before it is swept or use damp mops or cloths for cleaning it.

Consumptives, when not confined to the bed, should occasionally wash their hands in a disinfectant solution, such as 2.5 per cent carbolic acid or 1 per cent tricresol or lysol. After handling a consumptive or any infected material the hands of the attendant should be washed in one of the solutions just mentioned.

Upon the permanent vacation of the quarters occupied by a consumptive, whether through death, removal, or recovery, the room, and preferably the entire building, should be disinfected with formaldehyd gas, as described on page 9. The ingredients for producing the gas not being available, sulphur dioxid (pot method) should be used. The treatment of the room, bedding, etc., following the gaseous disinfection should be as has been prescribed for smallpox.

LEPROSY.

Leprosy is a communicable disease caused by the *Bacillus lepræ*. It is not as highly communicable as tuberculosis, but in many other ways the two diseases are very analogous. The germs of leprosy are contained in the lesions of leprosy in enormous numbers, and therefore they are being continually thrown off with the scales, discharges, etc., from the lesions of those suffering with the disease. The nasal secretions of lepers usually contain the germs in large numbers, and consequently many of them are eliminated from the body in these secretions.

The way in which the disease is communicated from the leper to the nonleper is not well understood, but it has been observed that a

nonleper sometimes contracts the disease after having lived or associated with a leper.

There is no doubt that lepers should be segregated, but ample provision should be made for their maintenance and comfort. The same thing said of tuberculosis would undoubtedly hold true were it possible of accomplishment, but the segregation of all those suffering with tuberculosis is, from an economic standpoint, impossible.

The principles of disinfection for leprosy should be carried out along the same lines as for tuberculosis, which it so closely resembles, particular attention being paid to the nasal secretions. The Leprosy Investigation Station[1] has found a nasal spray of value in freeing the nasal discharges from the bacilli. The nasal cavity is sprayed three times a day with acetozone inhalant (acetone 1 per cent, chlorotone 0.5 per cent in liquid petrolatum).

(5) PLAGUE—TYPHUS FEVER—YELLOW FEVER—MALARIA—DENGUE.

PLAGUE.

Plague, also called bubonic plague, black death, etc., is a communicable disease caused by the *Bacillus pestis.* Patients suffering with plague may give off the germs of the disease in all the discharges from the body, but especially in the sputum and feces. Plague is communicated largely through the agency of insects, particularly fleas, bedbugs, lice, etc. Rats, mice, squirrels, guinea pigs, monkeys, cats, etc., are susceptible to the disease; and among rats, mice, and squirrels it may occur in fatal epidemic form.

Fleas become infected by feeding on the blood of plague-sick animals, after which they may carry the infection either to other animals or to human beings. Fleas are largely responsible for the transmission of plague, but it may also be transmitted by bedbugs, lice, flies, etc. Although an unsettled question, it is possible that plague infection may be communicated to man through food that has been contaminated by plague-infected rats or insects.

The principal disseminators of plague infection, then, are *rats,* indirectly by having the disease and harboring fleas, which carry the infection from rat to rat; and, second, *fleas* directly by becoming infected from plague-sick rats or humans and carrying the infection to healthy persons.

Isolation.—Plague should be isolated in the same manner as has been prescribed above for the isolation of smallpox.

Disinfection.—Disinfection in plague prevention is directed largely toward the destruction of rats, mice, fleas, bedbugs, flies, and other

[1] "Studies upon leprosy (a palliative treatment for leprous rhinitis." By James T. Wayson and A. C. Reinecke.) Public Health Bulletin No. 33, United States Public Health & Marine-Hospital Service, Washington, 1910, p. 15.

animals and insects that may transmit the infection. Rats, mice, squirrels, etc., in a plague-infected territory should be exterminated as completely as possible. Use sulphur dioxid, traps, poison, etc., and as soon as the animals are killed they should be burned. The floor of the sick room of a plague patient should be sprinkled occasionally with pyrthrum powder in order either to kill the fleas and other insects or to keep them away from the patient. Sweepings from the room should be burned. Sputum feces, urine, and other discharges from the patient should be disinfected with one of the following solutions: Five per cent carbolic acid, 5 per cent formalin, 2 per cent tricresol, or lysol, chlorinated lime, etc. Soiled bed linen, towels, handkerchiefs, and other objects that have come in contact with the patient should be disinfected by immersion in one of the disinfectant solutions just mentioned or by boiling. The hands of the nurse should be washed in a solution of carbolic acid or bichlorid of mercury.

Upon the termination of the disease the room should be liberally sprinkled with pyrethrum and then fumigated with sulphur dioxid as an insecticide (see p. 24). Following this fumigation, the mattress should be burned, the bedclothes, etc., burned or boiled, and if any lice or bedbugs are present they should be killed, either with boiling water, gasoline, or in some other way.

TYPHUS FEVER.

Typhus fever, also known as spotted fever, jail fever, ship fever, *tabardillo*, etc., is a communicable disease, the cause of which is unknown. The disease is conveyed by the body louse, *Pediculus vestimenti*.[1] The louse, by biting a patient suffering with typhus fever, becomes infected, and it may then transfer the infection to healthy persons by biting them.

Patients suffering with typhus fever should be isolated lest healthy persons entering the sick room become infested with infected lice.

Disinfection.—The preventive measures should be rigidly carried out toward the destruction of the louse. When a case of typhus fever is discovered the patient's clothing should be removed and immediately boiled or placed in a 1 to 500 bichlorid of mercury solution in order to kill the lice and their eggs. Another bed should be provided for the patient and the framework of the one just vacated should be scalded with boiling water or the lice killed in some other way. The mattress should be burned, and the bed clothing boiled or placed in a 1 to 500 bichlorid solution. Parts of the room likely to harbor lice should be scalded with boiling water. The patient's

[1] Public Health Reports, vol. 25, Feb. 18, 1910, p. 177.

hair should be clipped and the clippings burned. The patient should then be given a thorough sponging with a 1 to 1,000 solution of bichlorid of mercury. The discharges from the patient are not thought to contain the infection of typhus fever; therefore their disinfection is thought to be unnecessary.

Following the removal of the patient from the room, the mattress, bed clothing, etc., should be treated as above stated, and then the room should be given a thorough fumigation with sulphur dioxid, as has been prescribed for the destruction of lice. Following the fumigation, the framework of the bed, the floor, walls, etc., of the room should be soaked with boiling water or saturated with petroleum, gasoline, or some other method of killing lice enforced. The use of petroleum, and particularly of gasoline, is of course attended with danger from fire.

YELLOW FEVER.

Yellow fever is a communicable disease, the cause of which has not yet been discovered. The disease is transmitted by the bite of a mosquito, the *Stegomyia calopus*. In order for this mosquito to transmit the disease it is necessary that it be infected by biting a human case of yellow fever. About 14 days after thus becoming infected, it may transmit the disease to nonimmune persons by biting them; this it may do during the remainder of its life. It is only in the manner just stated that yellow fever is transmitted from sick to healthy persons.

Yellow-fever patients should be isolated on account of the possibility of their quarters harboring infected mosquitoes.

The preventive measures against yellow fever consist of screening the patient and the destruction of the mosquito. The patient, therefore, should be kept in a well-screened room and, as a further precaution, in a bed covered with mosquito netting.

Following the removal of the patient, the room, and preferably the entire building, should be fumigated with sulphur dioxid, as described for the destruction of mosquitoes on page 25. Pyrethrum may be used, but it is not nearly so efficient for killing mosquitoes as is sulphur dioxid.

MALARIA.

Malaria is a communicable disease caused by the *Plasmodium* of malaria. It is transmitted only by the bite of a mosquito of the group known as *Anopheles*. The mosquito becomes infected and transmits the disease in a manner very similar to that described for yellow fever.

Administering quinine, screening the patient, and destroying the mosquito are the preventive measures to be carried out against malaria. However, effective screening of the patient becomes a difficult problem when consideration is given to the widespread prevalence of malaria and to the fact that the mosquito may become infected by biting a case of malaria long after the patient has apparently recovered from the disease.

DENGUE.

Dengue is a communicable disease, the cause of which is unknown, but is transmitted by the bite of a mosquito, the *Culex fatigans*. This mosquito may transmit the disease to nonimmune persons by biting them almost immediately after the mosquito has fed on the blood of a patient suffering with dengue.

As to how long the mosquito after becoming infected is capable of infecting nonimmune persons is not known.

The measures for preventing dengue should be carried out in the same manner as they are carried out in the case of yellow fever.

LIST OF PUBLIC HEALTH BULLETINS.

The following is a list of the public health bulletins that have been issued. Beginning with No. 32 they have been numbered on the cover, the previous editions having been numbered arbitrarily. Copies of those available for distribution may be obtained by addressing the Surgeon General, Public Health and Marine-Hospital Service.

*1. Report on Trichinæ and Trichinosis. By W. C. W. Glazier. 1881. 212 pages. 87 il. 1 map. Paper. Senate Executive Document No. 9, Forty-sixth Congress, third session. Out of print.

*2. Report on the Etiology and Prevention of Yellow Fever. By George M. Sternberg. 1890. 271 pages. 21 pl. 20 il. Cloth. Out of print.

*3. Mortality Statistics in the United States for the Year ending December 31, 1897. From Annual Report Marine-Hospital Service, 1898. 24 pages. Paper.

4. Yellow Fever: Its Nature, Diagnosis, Treatment, and Prophylaxis and Quarantine Regulations Relating Thereto. By officers of the Marine-Hospital Service. Reprint from Annual Report Marine-Hospital Service, 1898. 176 pages. 1 il. Paper.

*5. Shipment of Merchandise from a Town Infected with Yellow Fever. By H. R. Carter. 1899. 15 pages. Paper. Out of print.

6. Report of Commission of Medical Officers Detailed by Authority of the President to Investigate the Cause of Yellow Fever. By Eugene Wasdin and H. D. Geddings. July, 1899. 98 pages. 26 charts. 2 il. Paper.

*7. The Bubonic Plague. By Walter Wyman. January, 1900. 50 pages. Paper. Superintendent of Documents, 5 cents.

*8. Report of Commission appointed by the Secretary of the Treasury for the Investigation of Plague in San Francisco. By Prof. Simon Flexner, Prof. F. G. Novy, and Prof. L. F. Barker. January 23, 1901. 23 pages. 1 map. Paper. Out of print.

*9. Report Relating to the Origin and Prevalence of Leprosy in the United States. By a Commission of Medical Officers of the United States Marine-Hospital Service. 1902. 119 pages. 25 il. Paper. Senate Document No. 269, Fifty-seventh Congress, first session. Superintendent of Documents. Cloth, $1.00.

*10. Plague Conference. Containing a copy of the address of the chairman, and resolutions passed by a conference called in accordance with requests from a number of State Boards of Health, and under authority of section 7, act of Congress approved July 1, 1902, to consider the plague situation. Reprint from P. H. R. No. 4, Vol. XVIII, January 23, 1903. 9 pages. And February 6, 1903. 41 pages. Paper. Out of print.

*11. Transactions of the First Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. June, 1903. 120 pages. Cloth.

* Exhausted and not for distribution.

12. Transactions of the Second Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. June, 1904. 95 pages. Cloth.
13. The Public Health and Marine-Hospital Service of the United States. A Brief History. Prepared for the Louisiana Purchase Exposition. December, 1904. 16 pages. Paper.
*14. Sanatorium for Consumptives, Fort Stanton, N. Mex. By P. M. Carrington. Reprint from Annual Report Public Health and Marine-Hospital Service, 1904. 19 pages. Paper. Out of print.
15. Transactions of the Third Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. May, 1905. 52 pages. Cloth.
16. How to Prevent Yellow Fever—No Mosquitoes, No Yellow Fever. By Walter Wyman. July 31, 1905. 3 pages. Circular.
17. Transactions of the Fourth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. May, 1906. 75 pages. Cloth.
18. Transactions of the Fifth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. May, 1907. 47 pages. Cloth.
19. Trachoma. Its Character and Effects. By Taliaferro Clark and J. W. Schereschewsky. 1907. 34 pages. 6 il. Paper.
*20. The Public Health and Marine-Hospital Service of the United States. A Brief History. Prepared for the Jamestown Ter-Centennial Exposition. 1907. 12 pages. Paper. Out of print.
21. Transactions of the Sixth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. April, 1908. 79 pages. Cloth.
*22. The Present Pandemic of Plague. By J. M. Eager. 1908. 30 pages. Paper. Out of print.
23. Pellagra—A Precis. By C. H. Lavinder. July 24, 1908. 22 pages. 1 il. Paper.
24. The Marine-Hospital Sanatorum, Fort Stanton, N. Mex. Prepared for the International Congress on Tuberculosis, held in Washington, September, 1908. 32 il. 56 pages. Paper.
*25. Hookworm Disease. Reprint from Annual Report Public Health and Marine-Hospital Service, 1908. 5 pages. Paper. Out of print.
26. Studies upon Leprosy.
    I. The Present Status of the Leprosy Problem in Hawaii.
    II. The Reaction of Lepers to Moro's "Percutaneous" Test.
    III. A Note Upon the Possibility of the Mosquito Acting in the Transmission of Leprosy. By W. R. Brinckerhoff. 1908. Investigations made in accordance with the act of Congress approved March 3, 1905. 24 pages. Paper.
27. Studies upon Leprosy.
    IV. Upon the Utility of the Examination of the Nose and the Nasal Secretions for the Detection of Incipient Cases of Leprosy. By W. R. Brinckerhoff and W. L. Moors. 1909. Investigations made in accordance with the act of Congress approved March 3, 1905. 29 pages. Paper.

* Exhausted and not for distribution.

28. Studies upon Leprosy.
    V. A Report upon the Treatment of Six Cases of Leprosy with Nastine (Deycke). By W. R. Brinckerhoff and J. T. Wayson, Honolulu, T. H.
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I. STUDIES UPON PLAGUE IN GROUND SQUIRRELS (IN FOUR PARTS)

PART I. Pathology and bacteriology of plague in ground squirrels

PART II. Notes on induced plague in ground squirrels

PART III. Immunity of certain squirrels to plague infection

PART IV. Insect transmission in relation to plague among ground squirrels

II. A PLAGUE-LIKE DISEASE OF RODENTS

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ILLUSTRATIONS.

STUDIES UPON PLAGUE IN GROUND SQUIRRELS.

[From the Federal laboratory, San Francisco, Cal.]

By George W. McCoy,

Passed Assistant Surgeon.

Part I.—PATHOLOGY AND BACTERIOLOGY OF PLAGUE IN GROUND SQUIRRELS.[1]

PATHOLOGY.

This report is based upon the examination of 246 naturally infected plague squirrels that have come under observation at the Federal laboratory during the past two years. Our experience with this number has given us fairly well defined ideas as to the appearance of these rodents when infected with this disease. It is probable that we have seen practically all of the pathological changes found in plague in ground squirrels and it is believed that the tabulations of the various lesions represent with reasonable accuracy their average frequency. The majority of the cases in this report have been verified by the isolation of the pest bacillus directly from the squirrel, or from a laboratory animal inoculated from a squirrel. A smaller number have been diagnosed upon the evidence furnished by the gross lesions in inoculated rodents, and upon the results of the examination of stained smears either from the naturally infected squirrel, or from the inoculated animal showing the characteristic lesions of plague. This evidence was regarded as sufficient only when other rodents from the same vicinity had been proven by a more complete examination to be infected.

The method of dissecting squirrels requires no special description. The peripheral lymphatic glands must be completely exposed. The abdominal and the thoracic cavities must be freely opened. Some of our assistants have become very rapid and proficient in dissecting these rodents, one of them having opened and examined over 800 in one day.

In the early part of the work, smears were made routinely from many squirrels that showed no lesions, but it was found that the results did not justify the time consumed. It may be stated that,

[1] In this bulletin the term squirrel or ground squirrel always refers to the California ground squirrel (*Citellus beecheyi*, Richardson).

as is generally true of other animals, man, rats, or guinea pigs, unless there is some pathological change distinguishable to the naked eye, it is unnecessary to examine microscopically smear preparations from the rodents.

GROSS LESIONS.

The study of the gross lesions of natural squirrel plague has been somewhat complicated by the fact that the majority of the animals we received had been shot. The traumatism often destroyed relations, and led to hemorrhages that obscured lesions. In other cases the decomposition changes that had occurred led to alterations of color for which certain allowances had to be made.

CLASSIFICATION.

As is true of almost any infectious disease, the division of cases into several classes is somewhat artificial, but it is convenient for purposes of study, and may be adopted profitably. It is customary to classify the lesions of plague in rodents into the acute, and the subacute or chronic. In studying plague in ground squirrels, a purulent bubo without any other lesion is found to be so common that it is convenient to regard these cases as forming a separate class. For the purpose of this report, we divide the lesions of the disease in squirrels into acute plague, subacute plague, and residual plague buboes.

The following table compiled from our records shows the frequency of the several classes of cases, together with the facts in regard to the way the animals were secured, the size, and the sex:

Type of cases.	How taken.				Size.					Sex.			Total.
	Shot.	Found dead.	Alive (died in captivity).	Trapped.	Grown.	Three-quarter grown.	Half grown.	One - quarter grown.	Not stated.	Male.	Female.	Not stated.	
Subacute	133	16	2	1	105	24	19	......	4	89	55	8	152
Acute	50	9	......	1	30	11	16	3	......	35	22	3	60
Residual buboes	32	2	......	....	22	3	6	......	3	17	14	3	34
Total	215	27	2	2	157	38	41	3	7	141	91	14	246

LOCATION OF LYMPH GLANDS IN SQUIRRELS.

Before proceeding to a detailed consideration of the various types of cases, it is necessary to say a few words about the location of the lymphatic glands in squirrels. This is particularly important, as one or more of them will be found involved in about 84 per cent of all cases of plague.

The lymph glands in the neck are four or five in number on each side. They lie in a curved line around a large median structure, probably the thyroid. The axillary gland deserves no particular mention except the statement that it often rests in the center of a pinkish fatty mass which at first glance may be mistaken for diseased lymphatic tissue. The glands draining the posterior part of the body always require the most careful examination, as they are more frequently involved than those in the anterior part (axilla and cervical region). The lymph glands of the inguinal region and of the pelvis are found in three localities. The median inguinal is found near the midline just above the pubis. This structure is wanting in rats and in guinea pigs, but is constant in ground squirrels. Rather well back in the groin is found a chain of glands which often extends almost to the spinal column. We call these the posterior inguinal. The third set are those spoken of as pelvic glands. They are two in number, one on each side, and lie just at the bifurcation of the aorta. Analogous lymph nodes are found in other rodents.

The following table shows the frequency with which the several glands and groups of glands are involved in the various classes of cases:

Type of cases.	Total.	Location of bubo.					Multiple.	
		Cervical.	Axillary.	Median inguinal.	Posterior inguinal.	Pelvic.		
Acute	60	11	5	14	4	9	17	Axillary with inguinal ..... 3 Cervical with inguinal ..... 3 Multiple inguinal or inguinal with pelvic 11
Subacute	112	28	8	32	8	8	28	Bilateral axillary ..... 1 Axillary with inguinal ..... 1 Cervical with inguinal or pelvic ..... 7 Multiple inguinal or inguinal with pelvic 19
Residual buboes	34	7	1	10	6	4	6	Cervical with inguinal ..... 2 Multiple inguinal or inguinal with pelvic 4
Total with buboes	206	46	14	56	18	21		51

We have never seen a mesenteric bubo. In one case in which there was a cervical adenitis, a caseous gland was found just behind the sternum. The bubo in any of the types is frequently so large that it forms a distinct tumor mass readily recognized before an incision is made.

ACUTE PLAGUE.

We include here only those cases in which we found one or more hemorrhagic buboes without macroscopic necrotic foci in the internal organs. (Pl. I, fig. 1.) These constitute 24.4 per cent of the cases embraced

in this report. The gland is very commonly completely or partially surrounded by a bloody area. Occasionally a gelatinous exudate is found in the region. The contents of the bubo is dry, mealy, salmon colored, frankly bloody or blood tinged. A characteristic hemorrhagic gland may be present without any surrounding exudate. In a considerable number of cases the bubo will show a few points of blood-tinged pus, or the whole contents may be made up of grumous reddish purulent matter. Small subserous hemorrhages are found occasionally, particularly under the visceral pleura. Aside from a bubo, enlargement of the spleen was the most conspicuous lesion. This organ was usually deep red in color and quite firm in consistency. When decomposition had occurred it was soft and often slate colored. Occasionally it showed fine hemorrhagic points. It sometimes happened that we found buboes of different stages in the same animal; for example, a purulent cervical would be present along with caseous hemorrhagic inguinal glands.

SUBACUTE PLAGUE.

Under this head we have placed all cases in which there was a caseous bubo without evidence of surrounding hemorrhage, with or without macroscopic lesions of the internal organs; and those in which there were gross changes in the internal organs alone. The post-mortem findings varied greatly. A very few caseous granules in the spleen (Pl. I, fig. 2), or an abscess in the liver, sometimes constituted the only evidence of infection; on the other hand, we might have several necrotic glands and numerous large caseous foci in the liver, spleen, and lungs. The majority, however, presented a bubo along with foci in the spleen or the liver or both. This group contains 61.8 per cent of all cases considered; 73.7 per cent of them had buboes. The buboes were sometimes very large. It was not a very rare thing to encounter a cheesy gland 1.5 cm. in the long diameter. More frequently they were about 0.5 cm. through and contained a few necrotic points. Occasionally a pea-sized cheesy or purulent mass was found replacing part of the gland tissue. In some cases on account of numerous abscesses a honeycombed appearance resulted.

There was even more variation in the lesions in the internal organs than in the buboes. Cheesy or purulent foci were frequently found in the spleen, in the liver, in the lungs, or in two or more of these organs. The necrotic change was more commonly seen in the spleen than in the other organs. The nodules and the abscesses in the spleen may be very large. (Pl. II, figs. 3 and 4.) We have seen them almost as large as the last joint of one's little finger. In other cases numerous small purulent points may be found scattered throughout the organ. There was one case in which the only lesion was an

abscess about 1 cm. in diameter in the dome of the liver, the diaphragm being adherent over the surface of the organ.

Lungs.—We may have here either a pneumonic consolidation (Pl. III, fig. 5) usually rather grayish in color, or caseous or purulent areas (Pl. III, fig. 6; Pl. IV, fig. 7) similar to those found in the liver and the spleen. Caseous areas, especially the larger ones, sometimes appear to be in process of organization. This is true of the spleen and liver as well as of the lungs. In one case, a large abscess was found in the omentum, while in another, numerous small purulent foci were present.

Frequency of various lesions.—The following tabulation shows the frequency of lesions of the internal organs:

Organs involved.	Cases with— Buboes and internal lesions.	Cases with— Internal lesions only.
Spleen alone	17	9
Liver alone	6	8
Lungs alone	7	1
Spleen, liver, and lungs	6	3
Spleen and liver	26	17
Spleen and lungs	4	1
Liver and lungs	4	1
Total	70	40
Total cases spleen	53	30
Total cases liver	42	29
Total cases lungs	21	6

Adhesions.—Adhesions of serous surfaces were occasionally observed. When a lung was involved it was frequently adherent to the parietal pleura. When the liver was affected, the organ was often bound to the diaphragm. In a few cases the spleen was found to be adherent to the liver, to the abdominal wall, or to the omentum.

Jaundice was seen in several of the subacute cases, as well as in a few of the acute ones.

RESIDUAL BUBOES.

Under this head, we have considered those cases in which the only lesion was one or more purulent lymphatic glands. These constituted 13.8 per cent of all considered. Each one was verified by the inoculation of one or more laboratory animals. The glands were frankly purulent, the mass of pus usually being about as large as a pea (Pl. IV, fig. 8); occasionally it was much smaller than this, or the necrotic change was confined to a few points the size of a mustard seed. Sometimes the abscesses were very large, several being over 1 cm. in diameter. Quite often the process of softening was confined to a part of the gland, the remainder being fleshy looking, but without gross pathological changes. The pus was generally slightly yellowish, but never bloody.

The subacute cases were found at times in the same vicinity from which acute plague came; but occasionally they were received from sections of the country from which no other class of cases was secured. Probably it is largely a matter of accident that determines what type of squirrel plague is obtained from a given locality, as it is not likely that even in the districts where the most extensive shooting has been done we secure more than one out of every thousand infected animals.

GENERAL CONSIDERATIONS OF LESIONS.

When we compare the lesions of natural plague in the ground squirrel with those of the disease in other animals, the most striking feature is the extensive variations in the anatomical changes presented by the different examples of squirrel plague. In man, in rats, and in guinea pigs, the lesions in the great majority of cases are very uniform and constant. The subacute and chronic forms that constitute such a large percentage of the cases among squirrels are comparatively rare in other species. Squirrels are more closely related to the guinea pig than to most other rodents in which plague has been studied, but the guinea pig is notoriously susceptible and, as is well known, nearly always dies of acute plague when infected with a virulent culture. In a general way, we may say that lesions analogous to all of those observed in plague in squirrels may be seen in other animals, but that the percentage of types differs markedly. The acute type, which predominates in rats and in guinea pigs, is comparatively infrequent in squirrels, while the subacute type and residual lesions, so commonly seen in the latter, are relatively rare in the other rodents mentioned.

PLAGUE-LIKE DISEASE OF SQUIRRELS.

We have observed among squirrels an infection the lesions of which resemble plague very closely—so closely that even those who have had a large experience with both diseases may at times be unable to correctly judge as to whether the lesions in a given case are those of plague or of the plague-like disease. We may remark here that this disease causes plague-like lesions in the guinea pig and in certain other animals.

NEGATIVE CASES.

About 400 squirrels that were submitted to the inoculation test proved negative for plague. The cases fall into two classes: (1) Those which by bacteriological examination we were able to determine to be diseases other than plague; (2) those which we were unable to definitely diagnose. In the first class comes the above-mentioned plague-like disease and tuberculosis. The latter is very rare, but at least three cases have come under observation.

The second group comprises almost every conceivable lesion found in rodents. The fact was borne in mind that very little was known of the pathology of squirrel plague, and an animal presenting any abnormality that in the slightest degree aroused our suspicions was submitted to the inoculation test. The majority showed purulent lymph glands, many of which were microscopically indistinguishable from those we have called residual buboes. Others had abscesses in the viscera, especially in the spleen and the liver. Many of the rodents that had purulent lymph glands, with or without necrotic foci in the internal organs, were certainly examples of plague that had recovered. Such lesions are by no means common in squirrels, and the majority of the rodents in which they were found came from ranches and from localities that furnished infected animals.

Extensive adhesions of the liver to the diaphragm were very commonly met with in squirrels that had no other lesions. The animals almost always came from localities from which we had secured infected rodents.

SEASONAL PREVALENCE.

From the beginning of our work with plague infection in squirrels, the question has been kept before us as to whether there is any seasonal prevalence of the disease among these animals. It has been conclusively shown [1] that in certain parts of India there is a seasonal prevalence of rat plague, and that this coincides with epidemics of human plague. Without taking into consideration the distribution by months of cases of human plague of squirrel origin, which would introduce factors that need not be considered here, we may say that we have no reason for believing that squirrel plague is any more prevalent at one season of the year than at another. The figures for the cases by months have very marked variations, but a closer investigation shows that this is probably due to the changes in locations from which squirrels were sent. On one ranch that was found to be infected in June and July, 1909, infection was found again in January, 1910, and in June, 1910. We were inclined to believe that the disease prevailed most extensively during the summer until a heavy infection was found among the squirrels in Alameda County, Cal., in January 1910.

BACTERIOLOGY.

The bacteriology of squirrel plague does not differ materially from that of the disease in other animals. The organism, isolated either directly from a naturally infected squirrel or from a laboratory animal inoculated from a squirrel, is found to agree with the plague bacillus isolated from other sources. The evidence upon which the diagnosis

[1] Journal of Hygiene, Vol. VIII, No. 2, May, 1908, p. 266.

of squirrel plague is based was discussed somewhat fully in a previous paper.[1] It is sufficient to summarize this data by saying that a bacillus which is morphologically and culturally indistinguishable from *B. pestis* isolated from human beings and from rats in this country and abroad has been isolated from ground squirrels. This organism is pathogenic for the animals, guinea pigs, rats, mice, rabbits, and cats, which the pest bacillus is recognized as being capable of infecting; and does not affect certain animals, dogs and pigeons, that are known to be immune to *B. pestis;* furthermore, this organism has its pathogenic properties neutralized or diminished by the simultaneous injection of antipest serum made by the immunization of animals to foreign strains of the plague bacillus.

Theoretically it should have been possible to isolate the pest bacillus directly from the tissues of a large percentage of the infected squirrels. Practically this was not very often done, as the vast majority that were received had been shot at least 48 hours before they reached the laboratory. In most of them decomposition changes had begun, and in many were well advanced. While in some of these cases it would have been quite possible to have isolated the bacillus by cultural methods, the time consumed would have been greater than we could give to the work. It was a much more simple and certain procedure to inoculate a guinea pig or a white rat, and secure a culture from it. Another reason for the use of laboratory animals in this connection is the fact that while the cultural peculiarities of the pest bacillus are so well marked that the organism is not likely to be confused with any other, still in order to establish the diagnosis it is generally desirable to resort to inoculation experiments. It was just as satisfactory, and infinitely more convenient, to make the inoculation of a laboratory animal the first step in the procedure for identifying the organism as to make it the last one. We did not isolate *B. pestis* from all of the squirrels that were diagnosed and reported as plague infected. In a few cases when typical gross lesions were associated with characteristic organisms in smears, a diagnosis was made even if the effort to isolate the pest bacillus by cultural methods failed. In other cases the diagnosis was made when the gross lesions of plague were found at the post-mortem examination of an inoculated guinea pig or white rat, and when staining of smears from the tissues of the laboratory animal showed an abundance of typical bacilli. Cultures were nearly always made from the inoculated animals, but it occasionally happened that the growth was so badly contaminated that we failed to isolate the plague bacillus.

Unfortunately, it happened that frequently so large a number of suspected squirrels came to the laboratory on the same day as to make

[1] Public Health Reports, Vol. XXV, No. 2, Jan. 14, 1910, pp. 27–33.

it impracticable for want of time, and for lack of space in which to keep inoculated guinea pigs or white rats, to verify all of them by animal tests or by cultural studies.

MORPHOLOGICAL FINDINGS.

In the pathological classification of the lesions, those showing the presence of bacilli in smears were confined to two classes, the acute and the subacute. The lesions which were interpreted as representing convalescent stages of the disease were those that failed to show the bacilli in stained smear preparations or showed them in such small number as to be entitled to no weight in arriving at a diagnosis. The following table shows the frequency with which bacilli were found in cases in which the result of the microscopical examination was noted:

	Acute plague.	Subacute plague.
Present:		
Numerous	19	32
Few	12	13
Doubtful	5	17
Absent	6	74

Percentage of cases showing bacilli:

Acute plague	71.4
Subacute plague	33.0

When bacilli were recorded as "numerous" they were so plentiful as to cover practically the whole field; by "few" we mean several characteristic bacilli in a field; by "doubtful" we refer to those cases which showed in smears a very small number of organisms morphologically resembling the plague bacillus. These were cases in which the microscopical findings were considered as negative in reaching a conclusion as to the condition present. For practical purposes they may be classed with those in which bacilli were absent. When only an occasional pest-like organism was found, as well as when none at all were present, the record was made to read "absent." This is justified by the fact that many bacteria are morphologically very likely to be mistaken for *B. pestis*, but they are almost invariably few in number compared to the number of plague bacilli usually found in smears.

The organisms are not always uniformly distributed throughout an affected tissue. Smears from different parts of a lesion may give different appearances. It happened several times that a smear made from a bubo was negative, while a second one from another part of the same gland presented a typical appearance. When characteristic bacilli were present they were not always found in all of the lesions. Thus, while they were more often present in the bubo than in the internal organs, it occasionally happened that they were found in great abundance in the viscera and were absent from the

bubo. One rather remarkable fact in connection with the examination of stained smear preparations was the occasional finding of cases that yielded the involution forms that are so frequently found in old cultures of the plague bacillus and are so characteristic of the growth on salt agar. By involution forms we mean, not the spherical (coccoid) forms which are found usually in considerable numbers in pest smears from almost any source, but the large spherical, flask-shaped, hourglass, and dumb-bell forms.

CULTURAL INVESTIGATIONS.

Cultures from the infected squirrels or from an inoculated animal were made on agar slants. The needle was drawn over the surface of the slant two or three times, and frequently a second (and occasionally a third) tube was streaked with the needle after the inoculation of the first one. In the majority of cases, a pure culture was obtained. Occasionally colonies were present that were obviously due to the growth of a contaminating organism. In these instances a colony of what was believed to be *B. pestis* was "fished" with an inoculating needle and transferred to a second tube. After a study of the growth, cultures were always made upon 3 per cent salt agar, in broth and in litmus milk. After 24 or 48 hours at 37° C. the salt agar culture was examined for the characteristic involution forms. The broth tube was kept until a delicate surface film and flocculi suspended in the media were observed. The reading of the litmus milk was made after an incubation of 2 or 3 days at 37° C. and a further period of a week or longer at room temperature. Litmus milk was used for the purpose of excluding the *Bacillus pseudotuberculosis rodentium*, Pfeiffer. It is well known that this organism not only resembles the pest bacillus morphologically and culturally, but also produces plague-like lesions in guinea pigs. We have constantly borne this in mind and have used the greatest care to prevent any confusion or error due to the presence of this micro-organism. One of the chief points of difference [1] between it and the pest bacillus is the reaction on litmus milk, *B. pestis* producing no change or a trifling degree of acidity, while *B. pseudotuberculosis rodentium*, Pfeiffer, renders it strongly alkaline. It is for this reason that in addition to the media usually employed in the identification of *B. pestis*, we have used litmus milk. The plague bacillus gives no characteristic reactions on media other than those mentioned, but as a matter of routine, cultures have occasionally been made on sugar broths, blood serum, potato, and gelatin. There was no gas formation in either glucose or lactose, though the former was rendered slightly acid. No visible growth appeared on potato. There was no liquefaction of gelatin.

[1] MacConkey; Journal of Hygiene, Vol. VIII, No. 3, June, 1908, p. 335.

In another part of this bulletin a plague-like disease in ground squirrels is discussed. A clear distinction is to be made between a plague-like disease and a pestis-like organism. While plague-like diseases have been observed, none of them has been found to be due to an organism resembling the plague bacillus, nor indeed has any such organism been found during the course of this work.

INOCULATION OF ANIMALS.

VIRULENCE FOR GUINEA PIGS AND WHITE RATS.

Guinea pigs and white rats are so susceptible to infection with *B. pestis* that they are indispensable in laboratory work with plague. We have used guinea pigs much more extensively than white rats as early in our work it was found that squirrel plague frequently failed to infect white rats when inoculated with the same material that was successfully used on guinea pigs. In one series [1] in which tissue from 11 squirrels was used to inoculate guinea pigs and white rats (one of each in each case), all of the guinea pigs died of plague while 2 of the 11 white rats remained well. In other words, had we depended for the diagnosis upon the inoculation of white rats, 2 of the 11 cases would have been missed. It is not believed that the relative immunity of white rats is due to any peculiarity of the pest bacilli in squirrels other than that of somewhat reduced virulence. It is well known that as a rule white rats are not so easily infected with *B. pestis* as are guinea pigs. Even guinea pigs are not uniformly susceptible; thus it has happened, though very rarely, that when two were inoculated from the same tissue, one would perish while the other either developed plague from which it recovered or escaped entirely. That an occasional guinea pig is immune is well demonstrated by a recent experience at the Federal laboratory. Two guinea pigs were inoculated with the same dose of plague culture; one died on the seventh day, while the other remained well.

In the inoculation of animals, we used such tissues as we thought were most likely to reproduce the disease. For example, if the bubo was a small, purulent one without bacilli in smears, while the spleen presented a nodule containing characteristic organisms, the latter organ was used. The following tabulations show the day of death of the guinea pigs inoculated directly from squirrels. For the sake of comparison figures are introduced showing the day of death of animals inoculated from cases of rat plague. All refer to vaccinated guinea pigs.

[1] Journal of Infectious Diseases, Vol. VI, No. 5, November, 1909, pp. 676-686.

Length of life of animals inoculated with material from both squirrel and rat plague.

Day of death.	Squirrel plague—Federal laboratory.	Rat plague. Bombay.[1]	Rat plague. San Francisco, Wherry, Walker & Howell.[3,2]	Rat plague. San Francisco, Federal laboratory.
Second	...	3	...	...
Third	2	24	...	...
Fourth	15	23	...	6
Fifth	15	26	...	5
Sixth	22	18	...	4
Seventh	11	10	...	5
Eighth	7	2	...	...
Ninth	8	2	...	...
Tenth	2	2	...	...
Average duration of life ....days	6.0	4.8	4.9	5.4

[1] Advisory committee appointed by the Secretary of State for India, The Royal Society, and the Lister Institute, Journal of Hygiene, Vol. VII, No. 3, 1907, p. 350.
[2] Time preceding death, 2 to 8 days.
[3] Wherry, Walker & Howell: Plague Among Rats in San Francisco, Journal American Medical Association, Vol. L, Apr. 11, 1908, pp. 1165–1167.

In the table we have avoided using figures where animals survived over 10 days. It will be seen that the guinea pigs vaccinated from cases of rat plague died on an average of about one day earlier than those vaccinated from cases of squirrel plague.

Length of life of animals inoculated with material from the several types of squirrel plague.

Day of death.	Guinea pigs vaccinated. Acute cases.	Guinea pigs vaccinated. Subacute cases.	Guinea pigs vaccinated. Residual buboes.	Guinea pigs inoculated subcutaneously. Acute cases.	Guinea pigs inoculated subcutaneously. Subacute cases.	Guinea pigs inoculated subcutaneously. Residual buboes.	White rats vaccinated. Acute cases.	White rats vaccinated. Subacute cases.	White rats vaccinated. Residual buboes.	White rats inoculated subcutaneously. Acute cases.	White rats inoculated subcutaneously. Subacute cases.	White rats inoculated subcutaneously. Residual buboes.
Second	...	...	...	...	1	...	...	...	...	...	1	...
Third	...	2	...	1	6	...	...	1	...	...	2	1
Fourth	8	7			13	2	...	4	...	...	2	...
Fifth	2	10	3	4	19	7	...	2	...	...	1	...
Sixth	5	12	5	2	22	7	...	...		...	...	1
Seventh	4	6	1	1	14	2	...	...	...	...	...	...
Eighth	2	4	1		7	4	...	...	...	...	...	...
Ninth	1	7	...	1	3	2	...	...	...	...	...	...
Tenth	1	1	...	...	1	...	...	...		...	...	...
Eleventh	...	...			1	...	...	...	...	...	...	...
Twelfth	...	1	...	...	...	...	...	...	...	...	...	...
Thirteenth		2			2	1	...	...	...	...	...	...
Total animals used	23	52	10	9	89	25	...	7	...	...	6	2
Average duration of life... ... ...days	5.9	6.6	6	5.7	5.9	6.4	...	4.1	...	...	3.5	4.5

A study of this table shows that there is practically no difference in the duration of life of guinea pigs inoculated from the various types of squirrel plague. In addition to the animals used in the above table it happened a few times that when guinea pigs were chloroformed on the fourteenth day they were found to be suffering from chronic plague.

SUSCEPTIBILITY OF MONKEYS TO INFECTION WITH THE BACILLUS FOUND IN GROUND SQUIRRELS.

Monkeys have usually been found to be quite susceptible to infection with plague. This refers to the strains derived from human cases and from rats. It seemed worth while determining the susceptibility of these animals to the cultures isolated from ground squirrels in California.

A monkey (Java) was vaccinated with a culture of *B. pestis* isolated about three months before directly from the heart's blood of a naturally infected squirrel. A guinea pig, a white rat, and a ground squirrel, all vaccinated, served as controls. The results are shown in the following table:

[Culture from squirrel 701, seventh generation on agar.]

Animals.	Day of death.	Lesions.
Monkey	Eighth	Acute plague.
White rat	Sixth	Do.
Guinea pig	Seventh	Subacute plague.
Ground squirrel	do	Do.

A pure culture of *B. pestis* was isolated from the spleen of the monkey.

SUSCEPTIBILITY OF WHITE MICE.

We have not conducted any experiments for the express purpose of learning the susceptibility of white mice to the squirrel strain of *B. pestis*. However, a few of these rodents have been used in immunity investigations. Four were vaccinated with a culture of the squirrel plague bacillus. Three died of acute plague; the fourth remained well.

SUSCEPTIBILITY OF WHITE RABBITS.

Six of these animals were vaccinated with 48-hour agar cultures of *B. pestis*, a culture isolated from a different naturally infected squirrel being used for each. Guinea pigs and white rats served as controls. The results are shown in the following table:

Day of death.

Culture No.	White rabbit.	White rat.	Guinea pig.
245/3	Fourth; acute plague	Seventh; acute plague	Remained well.
665/2	Sixth; acute plague	Fourth; acute plague	Ninth, killed; small purulent bubo.
71/3	Ninth; killed; caseous bubo.	Seventh; acute plague	Fifth; acute plague.
361/3	Seventh; acute plague	Ninth; killed; negative	Remained well.
72/3	Sixth; acute plague	Fourth; acute plague	Do.
396/3	Fifth; acute plague	Ninth; killed; negative	Tenth; subacute plague.

Judged by the results of this experiment, the white rabbits would appear to be more susceptible to the cultures used than are either white rats or guinea pigs. We have no adequate explanation to offer for the irregular results obtained here.

SUSCEPTIBILITY OF DOGS, CATS, AND PIGEONS.

Cats and dogs.—In the first experiment three young cats were used. One was vaccinated with a 48-hour-old broth culture isolated from a natural-plague squirrel. This animal remained well and when chloroformed 22 days after the inoculation showed no lesions. Two were given 2 c. c. of the same culture, one receiving the injection subcutaneously and the other intraperitoneally. Both died on the fifth day. The one receiving the culture subcutaneously had a large gelatinous and purulent exudate over the front of the belly, a caseous bubo, and an enlarged spleen. The other presented at post-mortem a thin purulent peritoneal exudate which covered the liver and the spleen in the form of a rather sticky film. A pure culture of *B. pestis* was isolated from the liver and from the heart's blood of each cat. A guinea-pig control vaccinated with the same culture died on the fifth day with the usual lesions of acute plague.

Experiment No. 2.—Three cats were vaccinated with the liver of a guinea pig dead on the fifth day after inoculation from a naturally infected plague squirrel. One died on the fifth day, presenting at autopsy a small caseo-purulent bubo, an enlarged spleen, and considerable pericardial effusion. A pure culture of *B. pestis* was isolated from the heart's blood and from the spleen. The others were chloroformed on the eighth day. Neither presented any lesions.

Experiment No. 3.—Two small dogs and three small cats were inoculated subcutaneously, each with 0.5 c. c. of a 48-hour broth culture of *B. pestis* of squirrel origin. The dogs were chloroformed on the fifth day. Neither presented any abnormality beyond a small œdema at the site of the inoculation. One of the cats died on the third, one on the fourth, and the other on the fifth day. All presented lesions of plague. A pure culture of *B. pestis* was isolated from those dying on the fourth and fifth days. A guinea-pig control, inoculated subcutaneously with 0.1 c. c. of the culture, died of acute plague on the fourth day.

Pigeons.—But one experiment has been conducted with pigeons. Two were inoculated subcutaneously with 2 c. c. of a 3-day-old broth culture of the plague bacillus isolated from a squirrel. Neither appeared to suffer any ill effects from the injection and they did not present any lesions when chloroformed 18 days after inoculation.

The experiments with cats, dogs, and pigeons, although limited in number, give results similar to those observed when other strains (human and rat) of *B. pestis* are employed.

CROSS IMMUNIZATION EXPERIMENTS.

The subject of plague immunity is one too large to be discussed in this bulletin. Those who are interested in this are referred to Strong's [1] exhaustive review of the subject. We have been concerned especially in trying to determine by cross immunization experiments the relation of the bacillus found in plague in squirrels to that from other sources, and the relation to *B. pseudotuberculosis rodentium*, Pfeiffer.

Immunization by a strain of B. pestis of human origin.—We had in our possession a culture of the pest bacillus that had been isolated about 10 years ago from a human case in San Francisco. This culture was almost entirely avirulent. Two guinea pigs were immunized by inoculating them subcutaneously with living 4-day-old cultures of this organism. Following the injection, the animals were sick for a few days and developed a rather extensive brawny induration over the front of the belly. This swelling disappeared within a week. Twenty-four days after the immunizing injection, the rodents were vaccinated with a virulent culture of *B. pestis* of squirrel origin. Both remained well, and when chloroformed 12 days later, presented no lesions. Three guinea pigs were inoculated for controlling the virulence of the test dose. Two of these died of acute plague, one on the fourth and the other on the sixth day. The third control remained well, probably an example of natural immunity to plague in the guinea pig.

Immunization by a strain of B. pestis from India.—In this experiment the immunizing agent was an avirulent culture of *B. pestis*, the history of which is not known, except that it came originally from Bombay. A quantity of this culture, equivalent to about one-third of an agar slant growth, was used to immunize each guinea pig. Eighteen days later a test dose was given by vaccinating the animal with a 48-hour agar culture of virulent squirrel plague. The results are shown in the following table:

Guinea pig.	Day of death.	Lesions.
Immunized	Remained well	
Do	do	
Do	do	
Control	Seventh	Subacute plague.
Do	Fourth	Acute plague.
Do	Seventh	Subacute plague.

A glance at this table shows that the foreign avirulent strain of the pest bacillus immunizes very effectually against *B. pestis* of squirrel origin.

[1] Philippine Journal of Science, Vol. 11, No. 3, June, 1907.

Immunization by B. pseudotuberculosis rodentium, Pfeiffer.—As has been shown by several writers, the relation of this organism to *B. pestis* is in many respects a very close one. MacConkey [1] has reviewed the subject and added some experiments of his own. It is a most remarkable fact that this bacillus has the property of immunizing against *B. pestis*. One experiment of this nature is recorded here. Seven guinea pigs were inoculated with a live 48-hour-old broth culture of *B. pseudotuberculosis rodentium*, Pfeiffer, each being given 2 c. c. All of the animals were made sick for a few days, but soon regained their normal condition. Fifty-two days later, in order to test their immunity to the squirrel plague bacillus, they were vaccinated with a bubo from a guinea pig dead on the fifth day after vaccination from a naturally infected squirrel. One of the guinea pigs died; the remainder were chloroformed 70 days after the inoculation with plague. The results are shown in the following table:

Guinea pig.	Weight.	Lesions.	Remarks.
	Grams.		
No. 1	345	Large scar on belly; enlarged inguinal glands	
No. 2	235	Small purulent focus; left inguinal gland	
No. 3	190	None	
No. 4	170	do.	
No. 5		do.	
No. 6	540	Large scar on belly; enlarged inguinal gland	
No. 7	490	Had lesions of B. pseudotuberculosis rodentium. Cultures and smears negative, but a guinea pig inoculated subcutaneously with spleen was killed on seventeenth day and showed lesions of pseudotuberculosis rodentium.	Died fifty-first day after plague inoculation.
Control	350	Acute plague	Died sixth day.
Do	500	Subacute plague	Died eighth day.

In this experiment it will be seen that the previous inoculation very effectually immunized the guinea pigs against *B. pestis*, none of them showing any evidence of plague when examined, while the controls died of the disease.

A domestic strain of plague of human origin, a foreign strain, and *B. pseudotuberculosis rodentium*, Pfeiffer, all effectually immunized against the bacillus found in cases of plague in naturally infected ground squirrels.

SUMMARY.

The lesions of the various types of plague in ground squirrels, based upon the examination of 246 infected rodents, are described and the frequency of the several pathological changes stated. Especial attention is called to the predominance of the subacute type, and to the great variation in the lesions in the different cases.

Examination of stained smear preparations shows that in the majority of acute cases a probable diagnosis could be made by the micro-

[1] Journal of Hygiene, Vol. VIII, No. 3, June, 1908, p. 335.

scopical examination, while in most of the subacute and chronic cases this could not be done.

The bacilli present in squirrel plague would appear to be somewhat less virulent for guinea pigs than those from cases of rat plague in America and India. Guinea pigs, rats, mice, and rabbits are highly susceptible to the infection, cats moderately so; dogs and pigeons are probably immune, but the data available is scanty.

Cross immunization experiments demonstrated that avirulent cultures of *B. pestis* of domestic and of foreign origin, as well as a culture of *B. pseudotuberculosis rodentium*, Pfeiffer, immunize against the plague bacillus of squirrel origin.

Part II.—NOTES ON INDUCED PLAGUE IN GROUND SQUIRRELS.

These observations are based upon the examination of about 150 ground squirrels that have been inoculated in the course of various experiments conducted at the Federal plague laboratory, San Francisco, Cal., and at the branch laboratory at Oakland, Cal.

THE LESIONS OF EXPERIMENTAL PLAGUE.

When a squirrel is inoculated with a virulent culture of the plague bacillus, the pathological changes produced by the reaction of the tissues depend upon the susceptibility of the animal and, probably to a less extent, upon the dose and virulence of the culture used. If the animal is highly susceptible, death occurs on the third, fourth, or fifth day, and the lesions of acute plague are found at the autopsy. The post-mortem findings differ somewhat from those of acute plague in rats and in guinea pigs, but are analogous to the lesions seen in fatal cases in man when death occurs early.

If the squirrel is somewhat resistant but not entirely immune, lesions similar to those of subacute plague in other animals are found. In cases in which the rodent has offered enough resistance to the infection to have progressed rather far on the road to recovery, we have in the majority of instances a condition which for the sake of convenience we call "residual buboes." These cases present purulent foci in or at the site of the peripheral lymph glands. They may be compared to the purulent buboes seen in cases of plague in man when recovery is taking place. It is occasionally difficult to determine under which of these heads the lesions found in an animal should be classed, but as a rule one can determine this point without much trouble. The length of time that has elapsed between the inoculation and the death of the animal is not always a reliable indication of the lesions that will be found. It sometimes happens that a squirrel dying on the fourth or fifth day exhibits pathological changes that are as far advanced as those ordinarily found when death occurs on the seventh or eighth day. The separation of the lesions into these classes follows in general the divisions long recognized in plague in other animals, but on account of the frequency in the squirrel of the purulent lymphatic gland as the only evidence of infection it seemed well to make a separate class of the residual buboes. The classification of the lesions as those of acute plague,

subacute plague, and residual buboes has been found useful in the study of natural plague in squirrels. In over 400 naturally infected squirrels that have come under observation, we have seen duplicated all of the lesions that have been found in the experimentally infected animals.

ACUTE PLAGUE.

The term acute plague should be confined to the lesions that exist prior to the development of macroscopic necrotic foci in the internal organs. They are found when the animal dies between the third and the fifth or sixth day after infection. The post-mortem appearances are as follows:

Local reaction.—There is practically always an extensive lesion at the site of inoculation regardless of the mode of introducing the organism—that is to say, the reaction is present whether the infection is brought about by subcutaneous injection or by cutaneous inoculation (vaccination). The local reaction is generally in the form of a blood-stained slough surrounded by an elevated boundary of granulation tissue. The slough varies in size from 1 to 3 cm. in diameter or is even larger. When a section is made through one of these areas, it generally will be found that there is a hemorrhagic infiltration at the base and in the side walls of the lesion. At times the necrotic tissue has been detached and a deep ulcer is left. A rather extensive brawny thickening around the region of the slough is very common. The widespread gelatinous infiltration so commonly seen about the seat of inoculation in guinea pigs is not usually found in squirrels, though it occurs occasionally.

Occasionally the site of inoculation is marked by a rather firm nodule varying in size from a pea to the last joint of one's little finger. These nodules are somewhat caseous and are often hemorrhagic. In a few cases in which the animal dies on the third or fourth day, there may be no lesion beyond the reaction at the site of inoculation.

Subcutaneous injection.—This condition, so common in plague-infected rats, is rarely seen in squirrels.

The bubo.—One or more lymphatic glands will be found involved in practically all cases. The swelling caused by the enlarged lymph node can usually be detected before the region is incised. When an incision is made, the gland often will be found to be partially or completely surrounded by a bloody infiltration. A gelatinous exudate may or may not be present. In the majority of cases the gland is a little larger than a pea. The contents of the capsule is nearly always bloody and softened, and frequently, in addition to this, there is a more or less extensive purulent change. The pus may be present as a few mustard-seed-sized foci, or the whole of the gland may be converted into thick bloody pus. It may be said that in general

the tendency to purulent change is much more marked than is the case in either guinea pigs or rats.

Occasionally only one gland is involved; more often, a larger number. It is not very unusual to have both axillary and both inguinal lymph nodes converted into buboes. When the inguinal glands are affected, those at the brim of the pelvis are almost invariably involved. It may not be amiss to call attention here to the fact that in the ground squirrel there is a lymph gland lying just above the pubis and very near to the median line. There is no corresponding structure in either rats or guinea pigs.

The spleen.—Occasionally the organ is very little changed, but as a rule it is found to be enlarged to several times the normal size, firm, and rather dry. The normal lilac color is replaced by a deep cherry red. Small hemorrhagic points are common.

The liver.—This organ is unchanged except perhaps for some engorgement and enlargement.

The lungs.—In this type of cases the lungs may be normal, but very frequently subpleural hemorrhages are found. These extravasations may be mere points, or they may be 0.5 to 1 cm. in diameter.

Hemorrhages.—Subcutaneous hemorrhages not directly connected with the bubo are seen occasionally. Subpleural hemorrhages have been mentioned. Extravasations are occasionally found under the peritoneum covering the intestines in the omentum, or in the mesentery. Subpericardial hemorrhages are rather common, as are petechiæ on the surfaces of the kidneys and of the suprarenals.

SUBACUTE PLAGUE.

When a squirrel dies about the sixth day or later, the lesions are usually quite different from those that have been described under the head of acute plague.

Reaction at site.—The site of inoculation often shows no reaction beyond a small brownish crust. In other cases, an ulcer marks the site of the slough that has been thrown off. Occasionally there is a marked brawny thickening. A small, firm papule is at times the only mark left to show where the organism was introduced. A small subcutaneous abscess is found in a few cases.

The bubo.—The bubo is generally purulent or caseous, with but little or no evidence of hemorrhage into the gland or surrounding it.

In some cases there is no lesion beyond a bubo, but in the majority the internal organs are involved. They may be described as follows:

The spleen.—This organ is enlarged and presents caseous or purulent foci varying in size from a pin point to a mustard seed and in number from two or three up to so many that the spleen somewhat

resembles this organ in plague in the guinea pig. Sometimes caseous nodules as much as 1 cm. in diameter or larger are found. They may markedly distort the organ. In some cases the nodules seem to be in the process of organization.

The liver.—Granules and nodules similar to those found in the spleen are often encountered.

The lungs.—Granules and nodules like those found in the liver and in the spleen are often found. At times they are so numerous as to give the appearance of a fairly complete consolidation to the organ. The nodules are grayish red in color, and are surrounded by a well-defined deep-red zone. One remarkable example of complete consolidation of a lung has come under observation. In this case a squirrel was inoculated subcutaneously with a virulent culture of the pest bacillus. The animal died on the ninth day. At the post-mortem nothing was found at the site of inoculation beyond a small nodule. There was no bubo. The right lung, which was consolidated throughout, was grayish in color and showed the markings of the ribs on the pleural surface. The cut surface was firm, gray, and dry. There were two areas of softening in the consolidated organ, each one being about 1 cm. in diameter. Pleural exudate is rarely encountered. It may be serofibrinous, or fibrinous in character; the latter is always associated with gross lesions in the lungs.

RESIDUAL BUBOES.

It not infrequently happens that when a squirrel is killed two or three weeks or longer after inoculation, no lesions will be found beyond an enlarged lymph gland which contains yellow purulent foci, usually located just under the capsule. In other cases the site of the gland is marked by an abscess the size of a pea or larger. When these buboes are submitted to the inoculation test, they may or may not prove to contain virulent plague bacilli.

DISTRIBUTION OF BACILLI.

In practically all of the cases of acute plague there is a very heavy septicæmia, and organisms may be demonstrated in enormous numbers in the bubo, in the internal organs, and in the heart's blood. In the subacute cases, a septicæmia may or may not be present, but the bacilli are nearly always to be found in the bubo and in the lesions in the internal organs. In the cases where the only evidence of infection is a purulent bubo, with or without purulent foci in the internal organs, pest-like bacilli are rarely to be demonstrated in smears, although, as has been stated, some of these cases may be shown by the inoculation test to contain virulent bacilli.

SUMMARY.

The lesions of acute plague are an extensive necrosis at the site of inoculation, a hemorrhagic or caseous bubo, usually surrounded by a bloody exudate, and an enlarged spleen. Hemorrhages into the internal organs and into the subcutaneous tissue are common.

Subacute plague is indicated by the presence of a caseous or purulent bubo without much surrounding reaction. Granular or nodular lesions of the liver, spleen, and lungs may or may not be present.

Residual buboes are the result of an infection that is not sufficiently virulent to kill the animal.

DEVELOPMENT OF LESIONS.

This experiment was carried out at the suggestion of Passed Asst. Surg. W. C. Rucker, who thought that possibly certain early lesions of squirrel plague were overlooked by the laboratory assistants who dissected the rodents during the course of the investigation to determine the extent of squirrel plague in California.

Six squirrels were inoculated by the cutaneous method from the liver of a guinea pig dead on the fourth day after inoculation from a naturally infected squirrel. One was chloroformed after 30 hours and one every 24 hours thereafter. The object was to try to trace the development of the lesions. One of the squirrels died on the third day of plague, and one on the fourth day; consequently none were chloroformed on those days. The animal killed at the expiration of 30 hours showed nothing beyond a little dried serum at the site of inoculation, and would certainly have attracted no attention in the routine examination. It would perhaps be justifiable to speak of the disease as being in the stage of incubation. The squirrel killed on the next day (54 hours after inoculation) had a dried bloody scab at the site of inoculation; in addition, the spleen was enlarged. A few fine subpleural hemorrhages were present. There was no sign of a bubo. Unless the subpleural hemorrhages had attracted attention it is not at all likely that infection in this squirrel would have been detected during the routine examination. One of the squirrels died on the third day. It presented well-marked lesions—namely, a large bloody local reaction, hemorrhagic and caseating buboes, an enlarged spleen, and a blood-stained serous pleural effusion. This animal was pregnant, and the wall of the uterus was hemorrhagic, especially about the placental site. Another of the rodents died on the fourth day, and the lesions were similar to those found in the animal that had died on the preceding day, the only material difference being that the lesions were somewhat further advanced in caseation. The squirrel killed on the fifth day had large caseo-purulent buboes, and, in addition, the spleen was much enlarged and contained many fine

whitish granules. The animal killed on the sixth day had caseopurulent buboes, but no other lesions.

In order to get a satisfactory picture of the progressive stages in the development of the various lesions, it would be necessary to inoculate a considerable number of rodents and kill several each day. In this way an average picture would probably be obtained.

SUMMARY.

The lesions of induced plague in the ground squirrel are not clearly distinguishable until the third day after inoculation. Distinct focal lesions may be found in the internal organs (spleen) as early as the fifth day.

INFLUENCE OF SIZE OF DOSE.

Two experiments have been performed for the purpose of ascertaining the influence of the size of the dose of culture injected.

The culture used in the first experiment was one that had been isolated about eight months before directly from the liver of a natural plague rat found in San Francisco. A 48-hour agar growth was used.

The results are shown in the following table:

Dose of culture.	Day of death.	
	Guinea pig.	Squirrel.
0.0001 loop	Fourth	Fourth.[1]
0.00001 loop	Sixth	Sixth.
0.000001 loop	Eighth	Eighth.

[1] Intraperitoneally.

The results would apparently indicate that the size of the dose had some influence upon the length of time the animal survived after the inoculation. I am inclined to believe, however, that no such inference should be drawn from it. The squirrel that received one ten-thousandth part of a loop was inadvertently inoculated intraperitoneally instead of subcutaneously, and it is a well-known fact that intraperitoneal inoculation of *B. pestis* leads to a fatal result much earlier than when a culture is injected subcutaneously.

So far as the guinea pigs are concerned, other and more extensive experiments do not lend any support to the view that the variations in dose in this case made any material difference. The loop used took up approximately 266,000,000 bacilli from an agar culture; therefore about 266 bacilli was the smallest number injected. It is needless to remark that large errors are possible in the making of suspensions of the plague bacillus.

In the following table the experiment was originally designed to determine the influence of the size of the dose upon the relative

immunity of certain squirrels, but it seems to show that in susceptible animals the size of the dose has no material influence.

In this experiment a 48-hour broth culture of squirrel origin was used.

Dose of broth culture.	Weight of squirrel.	Day of death.	Dose of broth culture.	Weight of squirrel.	Day of death.
c. c.	*Gms.*		*c. c.*	*Gms.*	
0.01	560	Fifth.	0.00001	540	Twenty-sixth; killed; no lesions.
.01	420	Seventh.	.000001	370	Fifth.
.0001	360	Do.	.000001	510	Seventh.
.0001	640	Eighth.			
.00001	350	Fifth.			

It will be seen that the size of dose within the limits used had no influence upon the results. By a coincidence it happened that the two animals receiving the smallest dose lived just the same length of time as those receiving the largest dose. One of the squirrels used in this experiment was immune.

SUMMARY.

Considerable variations in the dose of culture used have no influence upon the length of time required to kill susceptible squirrels.

SOURCE OF CULTURES.

When the next experiment was performed we had at our disposal four cultures of the pest bacillus, two of which came from plague squirrels and two from human cases of plague that were of squirrel origin. One squirrel culture and one of the human cultures were isolated from infections at Los Angeles, Cal., and the others from cases occurring in Contra Costa County, Cal.

In each case a 48-hour agar culture was used to vaccinate the animal. The cultures had all been isolated directly from the naturally infected animals with the exception of the Los Angeles squirrel, which had been passed through a guinea pig in the process of isolation. These are shown by name in the table:

[Figures after name of culture indicate generation on artificial media.]

Source of culture.	Day of death.	
	Guinea pigs.	Squirrels.
Los Angeles, Cal.:		
Human (5)	Fourth.	Fourth.
Squirrel (5)	do.	Sixth.
Contra Costa County, Cal.:		
Human (3)	Fifth.	Fifth.
Squirrel (4)	Fourth.	Twelfth; killed; subacute plague.

SUMMARY.

The table indicates nothing more than that one of the squirrels used was more resistant than its fellows, and that cultures from plague cases (squirrel and human) in the southern part of the State (Los Angeles) where the infection was recent were as virulent as those from the northern part of the State (Contra Costa) where the disease had been present several years.

VIRULENCE OF BACILLUS PESTIS AFTER EXPERIMENTAL PASSAGE THROUGH GROUND SQUIRRELS.

These experiments were undertaken for the purpose of ascertaining whether there was any alteration in the virulence of the pest bacillus after passage through a series of ground squirrels. The question was of some practical importance, as it seemed probable that if any marked attenuation occurred the existence of plague among the ground squirrels of California assumed a different aspect from a public-health point of view than if full virulence was maintained. It has been claimed by some observers that passage of the pest bacillus through a series of rats leads to a reduction in virulence. Work along this line with the wild rats of San Francisco was complicated by the presence of a large percentage of immunity [1] to plague infection. I may say, however, that we have successfully carried the infection through five generations in wild San Francisco rats without apparent loss of virulence.

Technique.—Each series of squirrels was started with a pure culture of *B. pestis*, the origin of which is noted. When a squirrel died, the spleen or liver was used to inoculate another squirrel, and so on, until the end of the series. In nearly every case a guinea pig and two or more wild rats were inoculated in the same manner from the same material. The object of using the guinea pigs and wild rats was twofold: First, they served as controls for the virulence of the bacilli used to infect the squirrel; and second, we were able to learn if any change in virulence for these animals (guinea pigs and wild rats) was caused by the passage of the organism through the squirrels. The latter question is one of considerable importance, because if it should happen that passage through squirrels reduces the virulence of the organism for rats, squirrel plague would be of much less importance than if the organism remained fully virulent for rats. It is obvious that under natural conditions the strain of plague among squirrels must have passed through many more generations than we have found it practicable to carry it through experimentally.

The culture used for the first series was derived from a natural plague rat, taken in San Francisco, on July 28, 1908. The spleen of this rat was used to vaccinate a guinea pig. This guinea pig died on

[1] Journal of Infectious Diseases, Vol. VI, No. 3, pp. 289–295, June 12, 1909.

the sixth day after inoculation and a pure culture of *B. pestis* was isolated from its liver. The third generation of this culture on an artificial medium (agar) was used to inoculate a squirrel and a guinea pig.

The table shows the progress of the experiment. In every case all of the rodents (squirrels, guinea pigs, and rats) of any number were inoculated (vaccinated) from the squirrel of the preceding number. The inoculations were all made by shaving the skin of the belly so closely as to abrade the epithelium and leave a raw surface into which the culture or tissue was rubbed. The figures show the day of death of the various rodents.

SERIES NO. 1.

No.	Day of death.				
	Squirrel.	Guinea pig.	Rat No. 1.	Rat No. 2.	Rat No. 3.
1	Sixth	Sixth			
2	Fourth	Fourth	Fourth	Fourth	
3	Third	Sixth	Seventh	do	Sixth.
4	Fifth	Third	Third	Tenth; killed; no lesions.	Do.
5	Sixth	Fifth	Nineteenth; killed; no lesions.	Tenth; chronic plague.	
6	Fourth	do	Thirteenth; killed; no lesions.	Sixth	
7	do	Sixth	Twelfth; killed; no lesions.	Twelfth; killed; chronic plague.	
8	Fifth	Seventh	Tenth; killed; no lesions.	Eighth	
9	Third	do	Twenty-third; killed; no lesions.	Twenty-third; killed; no lesions.	
10	Fifth	Fifth	Seventeenth; killed; no lesions.	Fourth	
11	Fourth	do	Fifth	Seventh	Fifth.
12	do	Third; had early plague, also pneumonia.	Seventh	Fourth	Tenth; killed; chronic plague.
13	do	Third	Fifth	Fifth	Fifth.
14	Fifth	Fifth	Seventeenth; killed; no lesions.	do	Do.
15	do	do	Fourth	Seventh	Seventh.
16	Sixth	Seventh	do	Fourth	Fourth.
17	Fourth	Sixth	Eighth	Third	Do.
18	do	Eighth	Fifth	Fourth	Do.
19	Sixth	Fifth	Sixth	Seventh	Ninth.
20	Third	Fourth	Fonrteenth; killed; no lesions.	Fourteenth; killed; chronic plague.	Sixth.
21	Fifth	Third	Fifth	Second	Fourth.
22	Sixth	Fourth	Fourth	Thirteenth; killed; no lesions.	Thirteenth; killed; no lesions.
23	do	Fifth	Sixth	Sixth	
24	Third	Fourth	Fourth	Ninth; killed; no lesions.	Ninth; killed; no lesions.
25	Seventh	Sixth	do		
26	Sixth	Seventh	do	Twelfth; killed; chronic plague.	Fifth.
27	Fourth	Fourth; killed; no lesions.	Eleventh; killed; no lesions.	Eleventh; killed; no lesions.	
28	do	Fourth	Thirteenth; killed; no lesions.	Fifth	Fourth.

Average duration of life of squirrels, 4.7 days.

A guinea pig was inoculated from the last squirrel (No. 28). It died in four days of acute plague. The experiment was begun November 28, 1908, and terminated April 10, 1909.

The second series was started with a culture of the plague bacillus isolated directly from the lung of the first natural plague squirrel found in California. It had never been passed through a laboratory animal. The third generation (24 hours old) on agar was used to start the experiment. The chain was maintained as was the first by inoculation (vaccination) from the spleen or liver of the squirrels. The culture was originally isolated on August 6, 1908, and the series was begun on February 5, 1909; therefore, the culture had been isolated about six months prior to the beginning of this work.

SERIES NO. 2.

No.	Day of death.				
	Squirrel.	Guinea pig.	Rat No. 1.	Rat No. 2.	Rat No. 3.
1	Sixth	Eighth			
2	Fourth	Fifth	Thirteenth; killed; chronic plague.	Fourth	Sixth.
3	Fifth	None used	Twelfth; killed; no lesions.	Fifth	Do.
4	Seventh	Fifth	Fourth	do	Fifth.
5	Third	Sixth	Eleventh; killed; no lesions.	Eleventh; killed; no lesions.	Eleventh; killed; no lesions.
6[1]	Fourteenth; killed; no lesions.	Ninth	Sixth	Seventh	Sixth.
7	Sixth	None used	Fifth	Sixth	Seventh.
8	Fourth	Fourth	Fourth		
9	Seventh	do	do	Fourth	Fifth.
10	do	None used	Fifth	Fifth	Fourteenth; killed; chronic plague.
11	do	Fourth	Seventeenth; killed; no lesions.	Fourth	Sixth.
12	do	None used	Tenth; killed; no lesions.	Fifth	
13	Fifth	Third; beginning plague, died of pneumonia.	Fourteenth; killed; no lesions.	Fourth	

[1] Probably immune.

Average duration of life of squirrels, 5.25 days.

The second series was interrupted by encountering an immune squirrel (No. 6). It was, however, carried forward by giving the chain a fresh start, using a culture derived from squirrel No. 4.

On one or two occasions in each series the squirrel died within 24 or 48 hours after the inoculation, and presumably not from plague. When this happened another squirrel was inoculated from the spleen (which had been preserved on ice) of the preceding number in the chain.

A glance at the tables will show that there was no alteration in the virulence of the infecting organism for either squirrels, guinea pigs, or rats (*Mus norvegicus*).

Such variations in the time of death as occurred were probably due to varying susceptibility of the animals. As was to be anticipated, a large percentage of the rats proved immune. This agrees with the results of extensive experiments made to determine this point.[1]

SUMMARY.

Passage of the *B. pestis* through a series of 28 squirrels led to no alteration in virulence for squirrels, guinea pigs, or wild rats.

[1] Journal of Infectious Diseases, Vol. VI, No. 3, June 12, 1909, pp. 289-295.

Part III.—IMMUNITY OF CERTAIN SQUIRRELS TO PLAGUE INFECTION.

During the first year that the writer worked with experimentally infected ground squirrels, all of the rodents used were caught either in the city of San Francisco or in San Mateo County. This county, as well as the city of San Francisco, is located on the peninsula of San Francisco, and, so far as is known, the squirrels in this section have never had plague among them. Several hundred have been killed and examined, but no infection has been found. Inoculation showed that these squirrels were highly susceptible to plague, as failure to succumb to the infection was very rare. It seemed desirable to determine whether squirrels from the zone of squirrel plague in Contra Costa County, which is on the mainland, were equally susceptible. The squirrels from the two counties are of the same species. A number of those that were used in the following experiments were submitted to Prof. Joseph Grinnell, of the department of mammalogy of the University of California, for classification, and he pronounced those from the two counties to be identical.

The squirrels from Contra Costa County were caught at various points within the area known to be infected. In each experiment several squirrels from each county were inoculated with the same culture, in the same manner, and so far as practicable with the same dose. Before being used all of the animals were kept in stock long enough to exclude natural plague. In several of the experiments guinea pigs and white rats were used as "controls."

Experiment No. 1.

In this experiment the animals were all inoculated by the cutaneous (vaccination) method, with one loopful of a suspension in broth of a 24-hour-old agar culture of *B. pestis*. This culture had been isolated directly from the heart's blood of a naturally infected ground squirrel about three months before the present experiment was carried out. The fourth generation on agar was used.

Animals.	Weight.	Day of death.
	Grams.	
Guinea pig (control)	400	Sixth; acute plague.[1]
White rat (control)		Fifth; acute plague.
San Mateo squirrel	445	Do.[1]
Do.	600	Do.[1]
Contra Costa squirrel	360	Ninth; subacute plague.
Do.	Small.	Tenth; subacute plague.[1]
Do.	360	Fourteenth; killed; residual bubo.[2]
Do.	467	Do.

[1] Culture of *B. pestis* isolated from animal.
[2] Purulent lymph gland resulting from plague infection.

Judged by its effect on the guinea pig and on the white rat, it will be seen that the culture was fairly virulent. The two San Mateo County squirrels died early with the lesions of acute plague, while of the four Contra Costa squirrels two died of subacute plague and two had abscesses in the region of the lymph glands.

Attention is called to the fact that the squirrels which proved resistant averaged considerably less in weight than those that succumbed.

Experiment No. 2.

In this experiment the culture was one that had been isolated directly from a plague rat about 14 months before this work was undertaken. One loopful of a 48-hour agar culture was used to vaccinate each of the animals. The results are as follows:

Animals.	Weight.	Day of death.
	Grams.	
Guinea pig (control)	365	Ninth; subacute plague.
San Mateo ground squirrel	433	Fourth; acute plague.
Do.	542	Seventh; subacute plague.
Contra Costa ground squirrel	361	Third; acute plague.[1]
Do.	210	Second; no lesions.

[1] Culture of *B. pestis* isolated from animal.

This experiment is reported here merely for the purpose of recording all in the series, although it complicates rather than aids in solving the problem we are dealing with. That the culture was probably of low virulence is shown by the fact that the guinea pig died on the ninth day. One of the Contra Costa squirrels died about 48 hours after the inoculation, but the cause of death could not be ascertained. The other Contra Costa squirrel died on the third day with the usual lesions of acute plague.

Experiment No. 3.

In this experiment the spleen of a guinea pig that had died of acute plague on the fifth day after inoculation with tissue from a naturally infected ground squirrel was used to vaccinate each of the animals mentioned in the following table. On account of a shortage of guinea pigs no control was inoculated.

Animals.	Weight.	Day of death.
	Grams.	
San Mateo squirrel	545	Sixth; acute plague.[1]
Do.	445	Eleventh; subacute plague.[1]
Contra Costa squirrel	500	Eighteenth; killed; residual bubo.[2]
Do.	442	Do.

[1] Culture of *B. pestis* isolated from animal.
[2] Purulent lymph gland resulting from plague infection.

The Contra Costa squirrels were apparently in good health when they were chloroformed, although at the post-mortem examination one of them showed an old lesion of plague.

Experiment No. 4.

The same culture was used as in experiment No. 2, but the eleventh generation was used instead of the sixth. One loopful of a broth suspension of a 24-hour agar growth was used to vaccinate the animals.

Animals.	Weight.	Day of death.
	Grams.	
Guinea pig (control)	325	Sixth; acute plague.
San Mateo squirrel	630	Seventh; subacute plague.[1]
Do.	650	Fourteenth; killed; no lesions.
Contra Costa squirrel	360	Do.
Do.	320	Do.

[1] Culture of *B. pestis* isolated from animal.

Here, for the first time in the series, we encountered an immune San Mateo squirrel; both of the Contra Costa squirrels were immune to the culture used.

Experiment No. 5.

The preceding experiments were conducted with strains of the plague bacillus that had been isolated in California. It seemed wise to test a series of animals using a strain from a different source. Therefore, in the present experiment, the animals were all inoculated by the subcutaneous method with a broth suspension of a plague culture from the stock of the Hygienic Laboratory, Washington, D. C. This culture is known as "Jedda," and has been carried for several years upon artificial media. Each of the animals was given subcutaneously 0.5 c. c. of a suspension of a 48-hour agar culture.

The results, which are very similar to those obtained with what might be called native strains of the plague bacillus, are shown in the following table:

Animals.	Weight.	Day of death.
	Grams.	
Guinea pig (control)	380	Sixth; acute plague.
White rat (control)		Fourth; acute plague.
San Mateo squirrel	510	Do.[1]
Do.	380	Seventh; subacute plague.[1]
Do.	635	Ninth; subacute plague.
Contra Costa squirrel	780	Seventh; subacute plague.
Do.	700	Eighteenth; killed; no lesions.
Do.	560	Do.

[1] Culture of *B. pestis* isolated from animal.

In this case the dose of culture was very large, but in spite of this fact only one of the Contra Costa County squirrels died, while all of those from San Mateo County succumbed to the infection.

Experiment No. 6.

This experiment was designed to show the influence of the dose of culture on the immunity of the Contra Costa rodents as well as to compare their susceptibility with that of squirrels from outside the plague zone. Instead of using animals from San Mateo County, as had been done in the previous experiments, we used those from other counties (Tulare, Ventura) which have never furnished plague infection, although it has been carefully searched for. The culture used was a 48-hour broth growth planted from an agar culture that had been isolated a few months before from a naturally infected squirrel.

	0.01 c. c. culture.		0.0001 c. c. culture.	
	Weight.	Day of death.	Weight.	Day of death.
	Grams.		*Grams.*	
White rat	115	Third	135	Twenty-sixth; killed; negative.
Guinea pig	360	Seventh		Eighth.
Do	400	....do	410	Do.
Contra Costa squirrel	365	Thirteenth; killed; negative.	535	Seventeenth; killed; negative.
Tulare squirrel	500	Fifth	360	Seventh.
Ventura squirrel	420	Seventh	640	Eighth.

	0.00001 c. c. culture.		0.000001 c. c. culture.	
	Weight.	Day of death.	Weight.	Day of death.
	Grams.		*Grams.*	
White rat	110	Twenty-sixth; killed; negative.	170	Twenty-sixth; killed; negative.
Guinea pig	475	Thirty-fifth; killed; negative.	440	Seventh.
Do	390	Thirteenth	420	Thirteenth.
Contra Costa squirrel	700	Seventeenth; killed; negative.	550	Seventeenth; killed; negative.
Tulare squirrel	350	Fifth	360	Fifth.
Ventura squirrel	540	Twenty-sixth; killed; negative.	510	Seventh.

Here all of the Contra Costa squirrels survived while all but one of those from the other counties perished. But one of the white rats died. We have noted that the squirrel plague bacillus is sometimes only slightly virulent for white rats.

In order to determine approximately the number of bacilli in each dose, agar plates were made from each dilution and the number of colonies counted after 72 hours at 37° C. The results were: 0.01 c.c., innumerable; 0.0001 c.c., innumerable; 0.00001 c.c., 430 colonies; 0.000001 c.c., 42 colonies.

The cultures were made after vigorous shaking of the suspensions which were made in 0.8 per cent sodium chloride solution. It is not believed that the number of colonies that appeared indicates more than approximately the number of bacilli in the smaller doses.

DISCUSSION.

When we come to consider the significance of the results of these inoculations, we are confronted at once by the question as to whether the apparent immunity of the Contra Costa rodents may not have been merely a matter of accident. It is quite true that in experiment No. 2 the San Mateo squirrels lived longer than those from Contra Costa County, but on the other hand, in all of the other experiments, the majority of the Contra Costa squirrels outlived the San Mateo squirrels very materially. In fact, many of them were found entirely normal when chloroformed. It seems hardly likely that a coincidence should account for the fact. The results shown in the various tables may be conveniently summarized as follows:

	Total used.	Died.		Killed.	
		Acute plague.	Subacute plague.	Residual bubo.	No. lesions.
Contra Costa squirrels	16	1	3	3	9
San Mateo squirrels and others from plague-free zone	19	8	9	....	2

Assuming that the Contra Costa squirrels are less susceptible to laboratory infection than are the San Mateo squirrels, we may for a moment consider what influence might account for this difference in susceptibility.

In the present case, the known fact that the squirrels in the one county (Contra Costa) have been exposed to plague infection for several years must be regarded as the cause of the relative immunity of the squirrels from that locality. This condition of increased resistance may have been brought about either by an acquired and possibly hereditarily transmitted immunity, or by the survival of animals that were naturally immune, and the descendants of such animals. At present we have no evidence bearing upon this point. It is not improbable that both factors play a part. It might be considered that the presence of the immunity was an indication of the dying out of the epizootic among the rodents of the infected county, but as we still find a large number of infected squirrels there, not much support is lent to this view.

We have suggested that this relative immunity of certain squirrels be put to practical use by regarding it as an index to the presence of

plague infection among these rodents even before actually infected animals have been found. The importance of this will be understood when it is explained that in the case of one county over 4,000 squirrels were examined before finding an infected animal. Now, if it can be shown that the squirrels from any county are highly resistant to the infection, as is the case with those from Contra Costa County, we would have fairly strong evidence that the rodents of that county had been the subject of an epizootic of plague. It is evident that the reverse is not necessarily true as highly susceptible squirrels might be present in part of a county if the infection had not reached the particular locality from which they were taken.

SUMMARY.

These experiments indicate that healthy squirrels from localities where the epizootic has prevailed for several years are decidedly more resistant to artificial infection with *B. pestis* than those from localities in which plague has not appeared among the squirrels.

Part IV.—INSECT TRANSMISSION IN RELATION TO PLAGUE AMONG GROUND SQUIRRELS.

PLAGUE BACILLI IN ECTO-PARASITES OF GROUND SQUIRRELS.

Several observers [1] have demonstrated the presence of *B. pestis* in ecto-parasites of man and of rats; therefore, it seemed desirable to determine the facts in regard to insects from the Sciuridæ.

The flea used in our work was *Ceratophyllus acutus*, Baker, the one most commonly found upon ground squirrels in California. The louse was *Hæmatopinus columbianus*, Osborn. For the identification of the lice I am indebted to Dr. L. O. Howard and Prof. Nathan Banks of the Bureau of Entomology, Department of Agriculture, Washington, D. C.

The evidence of the presence of *B. pestis* in the ecto-parasites under consideration rests upon two kinds of observations.

1. The examination of stained smear preparations made by crushing the parasite (louse or flea) and staining the films: The presence in such preparations of pest-like organisms of course would afford only presumptive evidence as to the nature of the infection. Previous workers [2] have noted that bacteria resembling *B. pestis* were not found in the stomachs of rat fleas other than those that carried pest bacilli. Our own observations made by crushing squirrel fleas give similar results. We have examined stained smear preparations from a large number of fleas taken from healthy squirrels, but have never encountered any organism that bore a close resemblance to *B. pestis*. In fact, they were generally free or almost free from bacteria of any sort. The only example we have of finding organisms in any number in crushed fleas other than those from plague animals was the following: A laboratory attendant captured a flea in the act of biting him on the forearm. The parasite which was identified as a *Ceratophyllus acutus* was crushed between slides. The stained smear showed a large number of organisms, some of which morphologically were quite like *B. pestis*. As we were working with plague-infected fleas and

[1] The reader is referred to Journal of Hygiene, Vol. VI, No. 4, 1906, p. 425, for a review of the subject, as well as for many experiments on insect transmission of plague.

[2] The advisory committee appointed by the Secretary of State for India, the Royal Society, and the Lister Institute, Journal of Hygiene, Vol. VII, No. 3, 1907, p. 398.

plague-infected squirrels, a searching inquiry was undertaken to ascertain the origin of the flea that bit this man. It was found that the only squirrel that he had handled on the day in question was one found dead in the stock cage. This rodent had a broken leg which was suppurating. Smears from the internal organs showed many bacteria, a few of which slightly resembled *B. pestis.* The animal showed none of the gross lesions of plague and bacteriological investigation confirmed the absence of the plague bacillus. At the time we examined the rodent no fleas were found on its body, but a number of lice were secured, crushed, and examined. The smears from these showed bacteria resembling those found in the flea that had bitten the man. While the evidence that the parasite found on the man had actually come from this squirrel is not conclusive, it is very probable that this was its origin.

In our experience lice taken from a healthy squirrel, even when kept several days before being crushed and stained, showed no organisms that would likely be mistaken for the plague bacillus.

2. The inoculation of a laboratory animal with feces from an insect, or with a part of the parasite's body: If the inoculated animal dies of plague, the evidence is conclusive that the pest bacillus was present in the feces or in the insect's body. It should be stated here that all of our work had been done with parasites derived from experimentally infected rodents.

The experiments of several workers [1] have shown that the feces of rat fleas are infected with plague bacilli, and our observations show that this is true for feces of squirrel fleas. Our work in this connection consisted of inoculation experiments alone; no microscopical examinations were made.

TECHNIQUE.

The following procedure was used: The flea or louse was crushed between two glass slides which were then separated. The one carrying the smaller film was stained and examined for pest-like bacilli, a note being made of the findings. The remnant of the insect on the other slide was gently removed with a small pledget of absorbent cotton moistened with normal salt solution and introduced into a pocket under the skin of a guinea pig.

When the fecal deposit was used for inoculation it was emulsified in a small volume of the saline solution and the suspension injected subcutaneously. The flea was transferred to a sterile test tube every day or two so as to separate the feces passed on different days.

[1] Journal of Hygiene, Vol. VI, No. 4, 1906, p. 425.

Plague bacilli in fleas.—In the following table is shown the results of the subcutaneous inoculation of guinea pigs with two squirrel fleas taken from a gray rat and three taken from a ground squirrel:

Flea No.	Sex of flea.	Species of flea.	Host.	Day of death of guinea pig.	Lesions in guinea pig inoculated with crushed flea.	B. pestis recovered from guinea pig.
1	Female	C. acutus	M. norvegicus	Sixth	Acute plague	Yes.
2	Male	do	do	do	do	Yes.
3	(?)	do	C. beecheyi	Eighth	Subacute plague	Yes.
4	Female	do	do	Eleventh	do	No.
5	do	do	do	Eighth	do	Yes.

Fleas 3, 4, and 5 had been removed from the host (squirrel) three days prior to the inoculation. Those from the rats, Nos. 1 and 2, were used immediately after removal from the rodent. In each case the stained film from the crushed insect showed a few pestlike organisms.

Plague bacilli in flea feces.—A squirrel flea (female *C. acutus*) taken from a plague squirrel was placed in a sterile test tube where during the ensuing few hours feces were deposited. A guinea pig inoculated with this material died on the sixth day and presented at autopsy the usual lesions of plague. A pure culture of *B. pestis* was isolated from the liver.

The following experiments were undertaken for the purpose of ascertaining if possible how long the feces of fleas remain infective. The insects were removed from a plague-infected squirrel soon after its death. The smears from the heart's blood of the rodent showed a heavy septicæmia. Feces passed by the fleas during various periods after removal from the host were used to inoculate guinea pigs.

Feces passed in 24 and 48 hour periods.

Flea No.	Guinea pig inoculated with feces passed in—			
	First 24 hours.	Second 24 hours.	Third and fourth 24 hours.	Fifth and sixth 24 hours.
1	Negative	Negative	Negative	Negative.
2	Death, ninth day; plague.	Death, eighth day; plague.	do	Do.
3	Negative	No feces	do	No feces.
4	Death, eighth day; plague.	do	do	Do.
5	Negative	Negative	do	Negative.

At the beginning of the above experiment two of the five fleas harbored the plague bacillus. After the second 24 hours all inoculations resulted negatively. The parasites were not fed during the period of observation.

Feces from fleas taken from another plague squirrel were collected at 24-hour intervals and used to inoculate guinea pigs. The results were as follows:

Flea No.	Guinea pig inoculated with feces passed in—			
	First 24 hours.	Second 24 hours.	Third 24 hours.	Fourth 24 hours.
1	No feces	Death, seventh day; plague.	No feces	No feces.
2	.....do	Death, eighth day; plague.	Death, fourth day; plague.	Death, tenth day; plague.
3	.....do	No feces	No feces	Death, eighth day; plague.

Two of the fleas harbored plague bacilli as late as the fourth day after removal from the host.

In both of these experiments the fleas were kept at room temperature.

Plague bacilli in lice.—A squirrel died of acute plague on the third day after inoculation. When examined a few hours after death, smears from the heart's blood showed a large number of characteristic bacilli. Six lice were removed from this animal; four were crushed at once, and all showed large numbers of characteristic pest-like bacilli. The remaining portion of each louse was inoculated into a guinea pig or a squirrel, with the following result:

Louse No.	Inoculated into—	Result.
1	Guinea pig	Died of acute plague on fourth day.
2	.....do	Died of acute plague on fifth day.
3	Ground squirrel	Died of acute plague on third day.
4	.....do	Died of acute plague on fifth day.

In every case the animals showed characteristic lesions of plague, and a pure culture of *B. pestis* was isolated, except from the guinea pig inoculated from louse No. 1.

Two of the lice were kept at room temperature until the fourth day, when one was found dead. Both were crushed and found to contain large numbers of pest-like bacilli. Parts of these lice were used to inoculate guinea pigs in the usual way (by the aid of a pledget of cotton), with the following result: Guinea pig inoculated from louse found dead, died of plague on the sixth day; that inoculated from louse killed, died of plague on the fifth day.

The following experiment indicates that a very large percentage of the lice harbor plague bacilli: Nineteen other lice from the same squirrel that furnished the insects in the preceding experiment were examined microscopically for pest-like bacilli four days after their removal from the host. Of 4 males, 2 showed such organisms and 2 were negative; of 15 females, all but 1 were positive.

A squirrel died of acute plague on the sixth day after inoculation. Twenty-nine lice were removed from this animal. Twenty-five of them were crushed and stained 24 hours after the removal from the host. Of this number, 20 showed pest-like bacilli, while 5 were negative. The remaining 4, which were put aside at room temperature, were found dead on the fourth day after their removal from the squirrel. These were used for inoculation experiments on guinea pigs. The rodents died of plague on the fifth, sixth, seventh, and tenth days, respectively, and a pure culture of *B. pestis* was isolated from each, with the exception of the one dead on the tenth day.

In another case a number of lice were taken from a squirrel which had died 4 days after inoculation; 17 were examined microscopically; 15 of them contained pest-like bacilli, while 2 showed no suspicious organisms. In this case a guinea pig inoculated from one of the crushed lice which showed bacilli died of acute plague.

The lice used for a series of inoculations to determine how long the parasites harbored virulent plague bacilli were removed from a squirrel dead of acute plague 6 days after infection. A smear from the heart's blood of this animal showed a large number of pest-like bacilli. Only those lice were used that showed characteristic organisms in stained preparations. Some of the lice examined on and after the sixth day showed objects which were interpreted as involution forms of the organism, similar to those found in salt agar growths. Indeed, the smears from some on the eighth and on the fourteenth days were noted as showing almost nothing but these forms; that is, practically no bipolar organisms were present.

The majority of the lice used were found dead upon the day of inoculation. All were kept at room temperature.

The results were as follows:

Time after removal of louse from host.	Louse killed or found dead.	Day of death of guinea pig inoculated with louse.	Lesions.
4 days	Killed	Eighth	Subacute plague.
Do.	Found dead	Fifth	Acute plague.
6 days	Killed	Eighth	Subacute plague.
Do.	Found dead	Fourth	Acute plague.
8 days	Killed	Fourteenth; killed	None.
Do.	Found dead	Sixth	Acute plague.
11 days	do	Fifth	Do.
Do.	do	Eleventh; killed	None.
14 days	do	Sixth	Acute plague.
Do.	do	Fifth	Do.
19 days	do	Sixth	Do.
Do.	do	Twentieth; killed	None.

NOTE.—The lice found dead may have died at any time subsequent to the last previous inoculation, as the containers were not examined in the interval.

Those lice used 19 days after removal from the host died after the fourteenth day; therefore this experiment demonstrates that lice from squirrels may harbor virulent plague bacilli for at least 2 weeks.

UNSUCCESSFUL ATTEMPTS AT INSECT TRANSMISSION.

On two occasions we have tried to transmit plague by removing a few fleas from a septicæmic squirrel and permitting them to feed upon a healthy one. The result was negative both times. The fleas were confined in a test tube and allowed to feed through the meshes of cheesecloth that covered the open end. This method had been used successfully by the workers in India [1] in experiments on rats and on guinea pigs. We may remark here that it is not especially difficult for a flea to escape through the meshes of the cheese cloth, and in our experiments this happened once or twice, but the insect was always recaptured.

We have made three attempts to transmit plague from one squirrel to another by putting lice from a plague animal showing septicæmia on a healthy one. In one case, 6 lice were used; in another, 11; and in the third experiment 44 were applied. The lice were placed among the hairs and near the skin. The result was negative in each case. In every instance control lice from the infected squirrel were crushed, and the resulting smears showed pest-like organisms. The parts of the controls used for inoculating guinea pigs caused plague in the rodents.

The conditions in such experiments are so highly artificial that the result of these attempts can hardly be accepted as negativing the possibility that lice may transmit plague infection.

FLEA TRANSMISSION.

The California ground squirrel almost always harbors a large number of fleas. The two species most commonly found are *Ceratophyllus acutus*, Baker, which has been used in all of our transmission work (except one experiment where rat fleas, *C. fasciatus*, were used), and *Hoplopsyllus anomalus*, Baker. The former is found much more frequently and usually in larger numbers. These experiments have been conducted in much the same manner as those by the earlier workers who have investigated the subject of flea transmission of plague. A rodent was inoculated with a virulent culture of the plague bacillus, or with tissue from an animal recently dead of the disease. Except in two cases, the strain used was of squirrel origin. Fleas were placed in the cage either at the time the rodent was infected, or after it sickened. After death, one or more healthy animals were placed in the cage with it, or fleas were picked from the dead rodent and placed in a clean cage with one or more healthy animals.

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[1] Journal of Hygiene, Vol. VII, No. 3, 1907, p. 382.

In most of our experiments the cage used was an ordinary galvanized iron garbage can, 33 inches high by 19 inches in diameter. About 6 inches from the top a diaphragm made of ½-inch mesh galvanized-iron wire screening was set on four angle irons. When an infected squirrel or rat was placed in the cage, or when infected fleas were placed on healthy animals, the screen was wired to the angle irons to prevent any possibility of the rodents escaping. The portion of the inner surface of the can above the diaphragm was smeared with "tangle-foot" to prevent the escape of any fleas that might be inclined to wander up the sides of the can. When guinea pigs were used, a crock usually replaced the garbage can. A muslin covered wire screen served as a lid for the container. In addition to these precautions, the cage was placed in a galvanized iron tank, in the bottom of which was a thin layer of kerosene. This served to form a moat through which it was believed no parasite could pass.

From squirrel to squirrel by means of squirrel fleas (December 16, 1909).—A ground squirrel was inoculated subcutaneously with a broth culture of *B. pestis* derived from a human case of plague. This animal died on the fifth day. Three days before its death, 100 fleas, *C. acutus*, were put in the cage with it. While yet warm the dead rodent was removed from the cage, and 27 live fleas were taken from its body. Two of these were crushed, and staining of the resulting smears showed an abundance of pest-like bacilli in each. The 25 fleas remaining were put in a clean cage with a healthy squirrel. This animal died of subacute plague 10 days later, the buboes being in the region of the median, posterior inguinal, and pelvic glands. A pure culture of *B. pestis* was obtained from the liver. This experiment is conclusive in showing that *C. acutus* may convey plague from a sick to a healthy squirrel. It should be stated here that all of the squirrels were kept in quarantine for at least a month prior to their being used for the experiment. This was to exclude the use of any naturally infected ones. In fact all of these squirrels were obtained in a region in which no plague squirrels have ever been found.

From squirrel to guinea pig by means of squirrel fleas (November 23, 1909).—A healthy squirrel was inoculated subcutaneously with a culture of *B. pestis* obtained from the Hygienic Laboratory, Washington, D. C., that is, it was not a California strain of the organism. This animal died on the seventh day, and at necropsy presented the usual lesions of subacute plague in the ground squirrel. Three days before death occurred, 82 fleas (*C. acutus*) were introduced. Four guinea pigs were placed in the cage with the dead rodent and permitted to remain for half an hour, after which the squirrel was removed and dissected. The object was to permit the fleas to desert

the dead animal, and to go to the live ones. The fate of these guinea pigs is best shown by the following table:

Guinea pig No.	Day of death.	Lesions.	Location of bubo.
1	Fifth	Acute plague	Left inguinal.
2	do	do	Do.
3	Sixth	do	Multiple: 1 right inguinal, 1 neck.
4	Ninth	Subacute plague	Multiple: bilateral inguinal.

From squirrel to guinea pig by means of squirrel fleas (November 23, 1909).—This experiment was begun on the same day as the one immediately preceding, and the same culture was used to inoculate the squirrel. This animal died on the ninth day, and presented at autopsy the lesions of subacute plague. Four days before death, 89 fleas (*C. acutus*) were placed in the cage. When the squirrel succumbed, 4 guinea pigs were introduced and allowed to remain with the dead animal for half an hour. The fate of these guinea pigs is shown by the following table:

Guinea pig No.	Day of death.	Lesions.	Location of bubo.
1	Eighth	Subacute plague	None.
2	Twelfth	do	Right axilla.
3	Sixteenth; killed	None	
4	do	do	

From squirrel to white rats by means of squirrel fleas (March 24, 1910).—A squirrel which was vaccinated with the bubo of a guinea pig dead on the fifth day after inoculation from a naturally infected ground squirrel, died on the fifth day. Two days before its death, 220 fleas (*C. acutus*) were placed in the cage. After death 45 fleas were picked from the body and placed in a cage with 3 white rats. Two of these animals died of acute plague 5 days after the fleas had been put in with them. In one the bubo was in the neck; the other had two buboes, one in the axilla and one in the inguinal region. The third white rat was chloroformed two days after the death of his fellows and was found to be entirely healthy. In this case the evidence of infection of the white rat by means of squirrel fleas is conclusive, as there was no other way in which they might have acquired the disease.

From guinea pig to guinea pig by means of squirrel fleas (October 12, 1909).—A guinea pig was vaccinated with tissue from a guinea pig dead after inoculation from a case of natural squirrel plague. Four days later 100 fleas (*C. acutus*) were put in the cage. The animal

died on the seventh day after vaccination, 3 days after the fleas were introduced, and presented the lesions of acute plague. The rodent was allowed to remain in the cage for 24 hours after death in order to give the fleas ample time to leave the body. After it was removed, 2 fresh guinea pigs were introduced. One of the latter died on the sixth, the other on the eighth day. Both had the usual lesions of plague, the buboes being in the inguinal region. A pure culture of *B. pestis* was isolated from each animal.

From white rat to squirrels by means of rat fleas (April 12, 1910).—A white rat was vaccinated with a bubo from a white rat dead on the sixth day after inoculation with a culture of *B. pestis* of squirrel origin. Four days later 107 rat fleas (*C. fasciatus*, Bosc), which had been starved for 48 hours, were placed in the cage with this rodent. The animal died about 24 hours after the fleas were introduced. Fifty fleas were removed from the body and were placed in a clean cage with a healthy squirrel. This animal died of plague 10 days later, the bubo being in the inguinal region. About an hour after the removal of the dead white rat from the cage, a healthy squirrel was placed in it. This rodent was chloroformed while moribund on the seventh day, and found to be suffering from plague. The bubo was in the inguinal region. From this squirrel, as well as from the one infected by introducing the rat fleas into a clean cage, a culture of the plague bacillus was isolated.

The question might be raised that some of the animals believed to have been infected by fleas in reality had contracted the disease from mere contact with contaminated surroundings, other than insects, or by ingestion of feces from the sick rodents. We have frequently placed healthy guinea pigs in cages with plague-infected ones, but have never observed any spread of the disease if fleas were not present. This agrees with the results of extensive experiments conducted by the advisory committee appointed by the Secretary of State for India, the Royal Society, and the Lister Institute.[1]

In the two following experiments an infected animal was placed in a cage with 6 healthy ones, but without fleas, while in an adjacent cage the same conditions obtained, and in addition 100 squirrel fleas (*C. acutus*) were introduced. In each case the infecting agent was a culture of *B. pestis* of squirrel origin.

From guinea pig to guinea pig by means of squirrel fleas (November 11, 1910).—In this experiment, both inoculated guinea pigs died on the third day. The 6 healthy rodents in the cage without fleas

[1] Journal of Hygiene, Vol. VI, No. 4, May, 1906, p. 509.

remained well while 3 of those in the cage into which the fleas had been introduced died of plague, as shown in the following table:

Guinea pig No.	Day of death.[1]	Lesions.	Location of bubo.
1	Tenth	Acute plague	Inguinal.
2	Thirteenth	Subacute plague	Cervical.
3	Nineteenth	do	Inguinal.
4	Remained well		
5	do		
6	do		

[1] Counting from beginning of experiment.

From white rat to white rat by means of squirrel fleas (November 11, 1910).—An experiment identical with the preceding one was carried out with the exception that white rats were used instead of guinea pigs. The inoculated rat in the cage in which there were no fleas died on the third day. Upon removing the body, it was found to be partly devoured. Three of the "contacts" died of acute plague on the eighth day after the beginning of the experiment (i. e., 5 days after the death of the inoculated animal) all of the buboes being in the neck. The location of the buboes led to the conclusion that probably the infection had been acquired by feeding on the body of the inoculated rat. The importance of the location of the bubo is fully discussed by the advisory committee previously referred to.[1] The three rats that remained were chloroformed on the twelfth day after the beginning of the experiment and were found free from lesions. Whether the 3 that escaped infection were less cannibalistically inclined than their comrades we do not know.

With the rats that were in the cage with the fleas, the results were very different. In this case the inoculated animal died on the third day and its body had not been mutilated. All of the "contacts" died of plague in the order shown in the following table:

White rat No.	Day of death.[1]	Lesions.	Location of bubo.
1	Eighth	Acute plague	Axillary and inguinal.
2	do	do	None.
3	Twelfth	do	Inguinal.
4	Thirteenth	do	None.
5	do	do	Axillary.
6	Fourteenth	do	Inguinal.

[1] Counting from beginning of experiment.

After the death of the last one, 6 fresh white rats were put in the cage. Prior to introducing them the dead rat was surrounded by a wire screen, so that the new tenants could not touch the dead rodent, yet an opportunity was given for fleas to leave the dead

[1] Journal of Hygiene, Vol. VII, No. 3, 1907, p. 382.

animal for a living host. Three of these rats were found dead 5 days later. All had typical lesions of plague, the bubo in one being in the axilla, in another in the inguinal region, and the third had multiple buboes, one in the axilla and one in the inguinal region. The other 3 rats were chloroformed and found free from lesions.

SUMMARY.

Plague bacilli have been demonstrated in squirrel fleas (*Ceratophyllus acutus*, Baker) and in the feces from these insects by the inoculation test. The bacilli have been demonstrated in feces 4 days after removal of the fleas from the host.

Squirrel lice (*Hæmatopinus columbianus*, Osborn) taken from septicæmic plague squirrels often harbor the plague bacillus. The bacilli have been demonstrated in the lice at least 14 days after their removal from the host.

It has been shown beyond question that plague may be conveyed from one ground squirrel to another or from a ground squirrel to white rats by means of squirrel fleas (*C. acutus*) and from a white rat to a ground squirrel by means of rat fleas (*C. fasciatus*).

It has been shown, but perhaps less conclusively on account of the rather remote possibility of infection from contaminated surroundings other than fleas, that plague may be conveyed from squirrels to guinea pigs or to white rats, among guinea pigs, and among white rats by means of squirrel fleas (*C. acutus*).

A PLAGUE-LIKE DISEASE OF RODENTS.

[From the Federal laboratory, San Francisco, Cal.]

By George W. McCoy, *Passed Assistant Surgeon.*

During the routine examination of ground squirrels we have encountered an infection the lesions of which are readily mistaken for those of plague. This disease also causes pathological changes in guinea pigs that are almost indistinguishable from those due to infection with *B. pestis* and occasionally produces plague-like lesions in rats and mice.

It is barely possible that we unknowingly have dealt with more than one disease entity, as no etiological agent has been discovered, and for a diagnosis we are compelled to rely upon the lesions produced in laboratory animals and the negative results of microscopical and cultural investigations. The post-mortem appearances in guinea pigs, where they are remarkably uniform and constant, afford the chief evidence upon which a diagnosis is based.

GEOGRAPHICAL DISTRIBUTION.

The disease has been observed in squirrels coming from many points. We have found it in those from nine counties, all lying between Los Angeles on the south and the Sacramento River on the north. The infection has been discovered in districts and even on ranches that have furnished plague squirrels as well as in those sections in which plague has not been demonstrated.

GROSS LESIONS.

GROUND SQUIRRELS NATURALLY INFECTED.

The following description is based upon the examination of 32 squirrels so infected:

Bubo.—The bubo is usually about the size of a pea, often larger, rather firm, and when cut presents a dry, yellowish, or blood-stained surface. Some hemorrhage is frequently found in the surrounding tissue. The gland structure is generally replaced by a firm caseous mass. Purulent glands have been seen, but are not common. In about 20 per cent of the cases a bubo was the only lesion observed.

Spleen.—When involved this organ is very much enlarged, perhaps to four or five times the normal size. It is fairly firm in consistency unless post-mortem changes have occurred. The color is generally

dark, almost black, or slate blue. Whitish or yellowish caseous granules varying in size from a pin's point to about 1 mm. in diameter, and in number from a dozen to so many as to be uncountable, are found throughout the tissue. They often project slightly above the surface of the organ. Pl. VI, fig. 11.

Liver.—Granules similar to those found in the spleen are frequently found in the liver, sometimes being more numerous than in the spleen. Quite often they are ashen gray in color.

Lungs.—These organs are very rarely involved, but in one case we have observed granules like those found in the liver and in the spleen. Occasionally the tissues are slightly jaundiced.

The following table shows the frequency of the various lesions in squirrels naturally infected:

Bubo:	
Present	29
Absent	3
Single—	
Inguinal	5
Axillary	4
Cervical	8
Pelvic	6
	23
Multiple—	
Inguinal and pelvic	4
Cervical and axillary	1
Cervical and inguinal	1
	6
Spleen granules:	
Present	24
Absent	8
Liver granules:	
Present	11
Absent	21
Lung granules:	
Present	1
Absent	31

INOCULATED SQUIRRELS.

As these animals were examined very soon after death, remarkably clear and distinct lesions were found. The only essential point of difference from the naturally infected squirrels was the presence of a local reaction at the site of inoculation. When the rodent had been infected by the cutaneous method (vaccination), there was a small scab and some thickening at the site, while occasionally a few papules were found. When the inoculation was by subcutaneous injection or

by implanting a piece of tissue in a subcutaneous pocket, there was a large purulent reaction, often hemorrhagic, occasionally gelatinous. The bloody exudate may extend to and surround the nearest lymph glands. Once or twice we have seen punctate hemorrhages in the lungs, and once a few granules.

Necrotic foci are constant in the liver and spleen of inoculated rodents dead of this disease, while in those naturally infected they are often absent. Probably this is due to the fact that often the latter are shot before the lesions have fully developed, while in the inoculated ones the disease is permitted to run its course.

INOCULATED GUINEA PIGS.

The lesions of the plague-like disease in these rodents are so similar to those of plague that while workers who have acquired a considerable degree of familiarity with both can usually differentiate them, yet cases are occasionally seen in which an error in the judgment of the gross lesions is made by the most experienced.

Reaction at the site of inoculation.—When a guinea pig has been vaccinated, there is a little thickening beneath the scab, often marked congestion, or a slightly hemorrhagic and occasionally gelatinous exudate. When the infecting material has been introduced beneath the skin, the reaction most commonly found is a dry, yellowish-white area resembling a membrane inserted between the muscles and the skin. Very rarely a large bloody exudate is seen.

Bubo.—When the inoculation is on the belly wall, the inguinal gland chains on both sides are usually enlarged and necrotic. (Pl. V, fig. 9.) The individual elements are about the size of a pea. The caseous matter is yellowish, dry, and sometimes hemorrhagic. A waxy appearance is quite characteristic. A bloody exudate surrounding the glands is rather frequent. The pelvic glands, those lying on each side of the midline just above the brim of the pelvis, are often involved when the primary bubo is in the inguinal region. In these cases fine pearly-white granules are usually seen following up the course of the great abdominal vessels. A bubo is a constant lesion, except in cases of intraperitoneal inoculation. It is present even in cases where the infection has been introduced through the nose (cervical) and in those where the disease has been induced by feeding (cervical or abdominal).

Spleen.—This organ is very large, friable, dark in color, and is almost always thickly studded with very distinct white granules up to 1 mm. in diameter (Pl. VII, fig. 13), which tend to vary in size more than do those in plague.

Liver.—Granules like those found in the spleen are very numerous although generally not so thickly set as in that organ. (Pl. VI, fig. 12.)

The liver sometimes shows irregularly shaped yellowish-green areas, the exact nature of which is not known.

Lungs.—Patchy congestion is common. Punctate hemorrhages are occasionally seen. Very rarely we see fine white granules similar to those in the liver and spleen. Serous pleural effusion has been observed on a few occasions.

In squirrels and in guinea pigs the lesions are remarkably constant. The animals always die of an acute infection, and there is very little variation in the findings in individual members of each species.

It is convenient to compare the lesions with those of plague as seen in ground squirrels and in guinea pigs by placing brief descriptions of the gross appearances of the two diseases in parallel columns. For the sake of completing the comparison the findings in smears and cultures are added to the table.

	Plague.	Plague-like disease.
Reaction at site, vaccination.	Brawny œdema with marked thickening.	Slight scab and moderate thickening.
Reaction at site, subcutaneous inoculation.	Large, œdematous, and purulent	Whitish membrane-like area, rarely œdematous.
Bubo	Surrounding exudate usually extensive; bubo dry, mealy, not waxy, often bloody.	Surrounding exudate less extensive; bubo waxy looking, pink, less frequently bloody.
Spleen	Enlarged; granules less distinct, usually more uniform in size.	Enlarged; very distinct discrete granules, often varying in size.
Liver	Granules usually absent or few in number.	Granules numerous and almost constantly present.
Lungs	Granular or nodular, lesions common	Lesions rare.
Smears	Characteristic bacilli	Negative.
Cultures	*B. pestis* readily recovered	Do.

The table refers more particularly to the guinea pig, though it is to a large extent applicable also to the ground squirrel. In a general way it may be said that the lesions differ from those of plague in degree rather than in character.

PATHOLOGICAL HISTOLOGY OF THE PLAGUE-LIKE DISEASE.

This subject has been investigated only superficially. The remarks apply to guinea pigs and to ground squirrels.

Glands.—The glands involved show an extensive focal infiltration of round and polynuclear leucocytes. In some of the areas the nuclei show evidence of disintegration.

Spleen.—Aggregations of round and polynuclear cells are found scattered throughout the organ.

Liver.—The lesions may be demonstrated particularly well in this organ. The infiltration of new cells is often in the region where the bile duct, hepatic artery, and portal vein lie together. The areas made up of round and polynuclear cells replace the liver tissue for the most part, though sometimes the large vesicular nuclei of the liver cells may be seen lying well within an area of infiltration. The

centers of the foci often show a tendency to stain rather deeply with eosin. In other words, the lesions (in general) are those of a focal necrosis and the formation of minute abscesses.

PATHOGENICITY FOR RATS.

Mus norvegicus.—The experiments on rats have given rather irregular and to some extent contradictory results. It was believed at first that the lack of success in infecting *Mus norvegicus* (tame white and wild) offered a ready means of distinguishing this interesting disease from plague, though it was borne in mind that rats in general, even white ones, are not so uniformly susceptible to plague as are guinea pigs. This is especially true of the strain of *B. pestis* isolated from ground squirrels.

In the first case of this disease that came under observation, one rat was vaccinated and another inoculated from the spleen of a guinea pig dead on the sixth day after inoculation from a squirrel. Both of these rats were chloroformed on the seventh day. The vaccinated one was found to be entirely normal, while the one inoculated by the subcutaneous method had a small purulent reaction at the site, enlarged superficial lymph glands, and an enlarged dark spleen. The control guinea pig died on the seventh day with the usual lesions of the plague-like disease. Tissue from the second case was used to vaccinate a white rat. This rat died on the third day with lesions strongly suggestive of plague. A guinea pig vaccinated with the same tissue died on the seventh day with the usual lesions of the plague-like disease. In a third case, a white rat vaccinated directly from the spleen of a squirrel was found to be entirely normal when chloroformed on the fourteenth day, while the control guinea pig died on the sixth day with the usual lesions. These rather contradictory results led to the performing of several other experiments.

Variation of dose.—It appeared to be wise to try the influence of graduated doses of the infecting agent upon rats. Accordingly, the following series of inoculations was made, each animal being injected subcutaneously with an emulsion made from the liver of a guinea pig dead on the eighth day after inoculation:

Animal.	Size.	Dose.	Result.
Gray rat	Grown	2 c. c. of emulsion	Killed twenty-fourth day; no lesions.
Do	do	do	Died sixth day; lesions as below noted.
Do	do	1 c. c. of emulsion	Killed twenty-fourth day; no lesions.
Do	Half grown	0.1 c. c. of emulsion	Do.
Guinea pig (control)	Grown	do	Died on sixth day; usual lesions of plague-like disease.

The rat that died on the sixth day presented an enlarged mottled spleen, a liver studded with fine whitish granules, and a hemorrhage in the right axilla. The latter we thought might be traumatic. Cultures from the liver and from the heart's blood remained sterile, the usual result in this disease. The spleen of this rat was used to vaccinate a guinea pig, and as the latter remained entirely healthy, it is not possible to say whether the rat died of the disease under consideration. It will be shown later that it has been possible to demonstrate the presence of the disease in rats by the guinea-pig vaccination test.

Intraperitoneal inoculation of white rats.—One experiment was performed for the purpose of ascertaining the effect of intraperitoneal inoculation. An emulsion of liver tissue from a guinea pig dead on the sixth day was injected into the abdominal cavities of two half-grown white rats. Both of the rats died; one on the third and the other on the sixth day. There were no lesions in either case beyond an enlarged spleen, and it would have been impossible to have assigned any particular cause for the death of these animals but for the fact that spleen tissue from each was used to vaccinate a guinea pig, with the result that both guinea pigs died of the plague-like disease, one on the sixth and the other on the seventh day.

Rats sometimes die after a considerable time, and while they present no distinct lesions it can be shown that they harbor the infecting agent. This is demonstrated in the following experiment. Spleen emulsion from a guinea pig dead on the sixth day was used to inoculate the animals mentioned:

Animal.	Size.	Dose.	Result.
Gray rat	Half grown	1 c. c. emulsion, subcutaneously.	Died thirteenth day; no lesions, but spleen used to vaccinate a guinea pig which died on ninth day with usual lesions.
Do.	do.	2 c. c. emulsion, subcutaneously.	Died on fifteenth day; no lesions; guinea pig inoculated, negative.
Do.	do.	do.	Died sixtieth day; no lesions; guinea pig inoculated, negative.
Do.	do.	0.1 c. c. emulsion, subcutaneously.	Died fourteenth day; no lesions.
Guinea pig (control)	410 grams	Vaccinated	Died sixth day; usual lesions.

When examined after death the first rat presented no lesions whatever, but the spleen used to vaccinate a guinea pig reproduced the disease in that rodent.

In another case a rat which died on the ninth day after subcutaneous inoculation had no lesions beyond an enlarged spleen, but the infection was reproduced in a guinea pig vaccinated from the rat's spleen.

In the following experiment the rats (wild *Mus norvegicus*) were apparently entirely refractory. Unfortunately guinea pigs were not

inoculated from them to determine whether they harbored the infection at the time they were killed. The infecting agent was spleen emulsion from a guinea pig dead on the seventh day after vaccination from a naturally infected squirrel.

Animal.	Weight.	Dose.	Result.
	Grams.		
Gray rat	230	1 c. c. spleen emulsion, subcutaneously.	Killed fourteenth day; enlarged spleen.
Do	265	1 c. c. spleen emulsion, subcutaneously.	Do.
Guinea pig	315	Vaccinated, spleen emulsion	Died sixth day; usual lesions.
Do	370	.....do	Do.

In addition to these experiments that have been recorded in detail we have inoculated a considerable number of white rats and gray rats. The great majority of these have proved immune to the infection.

Mus rattus.—One experiment has been performed with this species. Three of the rodents were inoculated with an emulsion made from the liver of a ground squirrel dead of the disease. One of the rats was vaccinated and two were inoculated subcutaneously. One of the latter died on the third day; the others remained well. A guinea pig (control) vaccinated with the same material died of the plague-like disease on the seventh day.

PATHOGENICITY FOR MICE.

With so low and uncertain a degree of virulence for rats it was thought that other members of the genus *Mus* would probably prove resistant, but attempts to infect mice negatived this view.

In the first experiment four gray mice were inoculated with the spleen of a guinea pig dead on the seventh day after vaccination from a squirrel. Two of the mice were infected by the subcutaneous method; one of these died on the third, the other on the fourth day. Two were inoculated by rubbing the spleen of the guinea pig on the shaved abdomen; one died on the fifth, the other on the sixth day. None of the mice presented any well-defined lesions. Two control guinea pigs died on the sixth day and presented the usual appearances of animals dead of the plague-like disease.

In the following experiment the dose was varied, and tissues from several of the mice were used to vaccinate guinea pigs for the purpose of ascertaining whether the mice had actually been infected with the disease (i. e., to exclude death from other causes).

The mice and the control guinea pig were inoculated subcutaneously with an emulsion made from the heart's blood of a guinea pig just dead of the disease.

Animal.	Dose.	Day of death.	Result of vaccination of guinea pig from spleen of dead mouse.
White mouse	Contaminated needle thrust under the skin.	Seventh	Dead sixth day; usual lesions of plague-like disease.
Do	....do	....do	No guinea pig used.
Do	0.1 c. c. emulsion, subcutaneously.	Fourth	Dead sixth day; usual lesions of plague-like disease.
Do	....do	Sixth	Do.
Do	1 c. c. emulsion, subcutaneously.	Fourth	Do.
Do	....do	....do	No guinea pig used.
Guinea pig (control)	0.1 c. c. emulsion, subcutaneously.	Seventh	

The lesions in mice are not very well defined. In one or two instances lymph glands were enlarged, and one was probably caseous. The spleen was usually several times the normal size, and rather obscure granules were found in a few cases in this organ and in the liver. In several other experiments mice have been inoculated, and in every case have succumbed to the infection.

PATHOGENICITY FOR RABBITS.

Rabbits (Belgian hares) have been used in two experiments. One was vaccinated with spleen from a guinea pig dead on the seventh day. This rabbit died on the tenth day; the control ground squirrel (also vaccinated) died on the ninth day. In the second experiment a rabbit was inoculated subcutaneously with 1 c. c. of spleen emulsion from a guinea pig dead on the seventh day. This animal died on the ninth day. A control guinea pig given the same quantity of the emulsion died on the fifth day.

Lesions.—In the case of the vaccinated rabbit there was a small scab at the site; in the inoculated one there was a necrotic area about 2 cm. in diameter where the injection was made. Buboes were present in each case, the glands being about the size of a pea, and full of small yellowish-white points. The spleen and the liver of each animal were full of whitish granules, the largest being the size of a mustard seed. In the case of the rabbit dying on the tenth day, the omentum was filled with granules and nodules, and the diaphragm was studded with white granules. A white rat was inoculated in each case from the same material that was used to inoculate the rabbit and the control guinea pig, but with negative results.

PATHOGENICITY FOR GROUND SQUIRRELS.

As this disease was found in ground squirrels in nature, special interest attaches to the experimental reproduction of it in these rodents. It has not been feasible to use ground squirrels as extensively as we wished because they are difficult to obtain alive. For this reason the great bulk of our work has been done with guinea

pigs, and it is of course important to establish that the disease in these animals is the same as that found in the naturally infected squirrels. This we have done by inoculating squirrels from guinea pigs.

In the first experiment, a piece of liver from a guinea pig dead on the fifth day (second remove from naturally infected squirrel) was placed in a subcutaneous pocket in a ground squirrel. This animal died on the sixth day. The lesions were a purulent and hemorrhagic reaction at the site, a bloody exudate extending down over the thighs, and a yellowish caseous bubo. The spleen was full of white granules, the largest being perhaps 1 mm. in diameter. The liver contained granules similar to those in the spleen. There were punctate hemorrhages in the lungs. Here we have an example of the transmission of the disease by inoculation from a naturally infected squirrel to a guinea pig, through two generations in the guinea pig, and back into the squirrel. In order to carry the demonstration one step further, two guinea pigs were vaccinated from the spleen, and two inoculated subcutaneously with a small amount of heart's blood from the squirrel. These rodents all died with the usual lesions and in the usual time.

In another experiment, a ground squirrel was vaccinated with the spleen of a guinea pig (second remove in guinea pigs from a squirrel) dead on the seventh day. The squirrel died on the eighth day and presented lesions similar to those above described, and in addition a few whitish granules were found in the lungs. Ground squirrels have been infected in several other experiments that are of no special interest in this connection. No case of immunity to this disease has been observed. It is apparently more regularly fatal to these animals than is plague.

PATHOGENICITY FOR GOPHERS (THOMOMYS BOTTAE).

In order to determine the susceptibility of the gopher, two of these rodents which had been in stock for over a year were used. One was inoculated subcutaneously with 1 c. c. of spleen emulsion from a guinea pig dead of the plague-like disease on the sixth day, and the other was vaccinated with a loopful of the same emulsion. The gopher inoculated subcutaneously died on the third day and presented a small bubo, and an enlarged spleen which contained a number of minute whitish granules. The vaccinated gopher died on the fourth day with a bubo and granular lesions in the spleen. There was a bilateral clear serous pleural effusion in this case. That the second gopher died of the plague-like disease is proven by the fact that its spleen was used for the purpose of inoculating a guinea pig which died with typical lesions on the fifth day.

PATHOGENICITY FOR ANIMALS OTHER THAN RODENTS.

MONKEYS.

Two experiments have been made on monkeys. In the first, two animals were used, both being inoculated subcutaneously; one with 1 c. c. of an emulsion made from the liver of a guinea pig dead on the seventh day, the other with 0.5 c. c. of a salt solution suspension of the heart's blood of the same animal. Guinea pig controls inoculated with 0.1 c. c. of the liver emulsion and 1 c. c. of the heart's blood emulsion both died on the sixth day with the usual lesions of the plague-like disease. The first monkey (Java) perished on the eighth day, and the second (Rhesus) on the seventh day. In one case there was at the site of inoculation a whitish necrotic area such as has been mentioned under the head of lesions in the guinea pig; in the other, nothing was found to indicate the point where the infection was introduced. In each, a rather small caseous lymph gland was found, and the spleen appeared to be very much swollen. In one case, numerous fine granules were present in that organ. The other tissues appeared to be normal. Cultures from one monkey were sterile. None were made from the other. While the writer has no doubt but that the monkeys died of this disease, it should be stated that a guinea pig vaccinated from the liver of the monkey that died on the eighth day remained well. The liver had been kept in the ice chest several days before the guinea pig was inoculated.

In another experiment, a guinea pig, four white rats, and four white mice were used as controls for a monkey (Rhesus). All of the animals were vaccinated on the abdomen with the spleen of a guinea pig dead on the fourth day.

The results are shown in the following table:

Animal.	Weight.	Day of death.	Remarks.
	Grams.		
Guinea pig	315	Fifth	Characteristic lesions.
Monkey [1]		Eighth	Plague-like lesions.
White rat	70		Remained well.
Do	60		Do.
Do	60		Do.
Do	40		Do.
White mouse		Fourth	
Do		do	
Do		Fifth	
Do		do	

[1] This monkey had proven immune to vaccination with a virulent culture of the plague bacillus.

A white rat and a guinea pig were inoculated from the spleen of the monkey. The former remained well, while the latter died on the sixth day with the usual lesions of the plague-like disease.

The following is a brief description of the lesions noted in this monkey: A caseo-purulent bubo was found in the axilla, and another

in the inguinal region. There was but little surrounding infiltration. The spleen was much enlarged and contained many caseous granules, varying in size from a pin point to 2 mm. in diameter. The other organs were negative.

CATS AND DOGS.

But one attempt has been made to infect these animals. Varying doses of a spleen emulsion of a guinea pig dead on the fifth day were employed to inoculate them subcutaneously. Three young cats and two young dogs were used and none of them appeared to suffer any bad effects from the inoculation. All were carefully examined on the fourteenth day and found to be without any reaction at the site of inoculation or any indication of a bubo. A control guinea pig died on the sixth day with the usual lesions of the disease. It would seem safe to infer that cats and dogs are probably not susceptible to this infection.

PIGEONS.

The spleen of a guinea pig dead on the seventh day after inoculation from a naturally infected squirrel was used to inoculate subcutaneously two pigeons. The birds remained alive and apparently well, while two control guinea pigs died on the sixth day with the usual lesions. A second experiment with pigeons gave a like result.

The susceptibility of animals to this disease and to plague is shown in the following table:

Animals, etc.	Plague.	Plague-like disease.
Monkeys	Susceptible	Susceptible.
Cats	Moderately susceptible	Immune.
Dogs	Immune	Do.
Guinea pigs	Susceptible	Susceptible.
Rats	do	Usually immune.
Mice	do	Susceptible.
Rabbits	do	Do.
Ground squirrel	do	Do.
Gophers	Moderately susceptible	Do.
Pigeons	Immune	Immune.

SYMPTOMS.

As to the clinical manifestations of the disease, but little is to be said. When an infected guinea pig is examined on the third day or later, a reaction at the site of inoculation is found, but it is by no means so conspicuous as that found in plague. The animal refuses food, sits humped up; the coat is rough and the eyes are closed. When the end approaches, the animal lies on its side, gasps for breath, and slight spasmodic movements of the body and limbs occur.

We are acquainted with the difficulty in drawing any conclusions from temperature observations in guinea pigs, as the rectal temperature varies materially in apparently healthy rodents. Our efforts to

determine whether the disease is a febrile one were confined to two series of temperature observations. In each case the control was kept in the same cage with the sick animal.

	Temperature (degrees F.) of—	
	Infected guinea pig.	Control guinea pig.
First experiment.		
At inoculation	101.3	101.2
48 hours after inoculation	102.6	98.6
72 hours after inoculation	103.6	99.6
Dead next day.		
Second experiment.		
At inoculation	99.6	97.6
First day:		
Morning	99.2	97.4
Evening	101.8	97.2
Second day:		
Morning	102.6	97.0
Evening	105.0	97.2
Third day:		
Morning	103.8	96.6
Evening	104.6	96.8
Fourth day:		
Morning	104.6	96.5
Evening	(1)	(1)
Fifth day:		
Morning	104.0	96.8
Evening	103.4	98.6
Sixth day:		
Morning	98.0	97.0
Evening	(2)	....

1 Omitted. 2 Animal dead.

METHODS OF EXPERIMENTAL INOCULATION.

SUBCUTANEOUS INJECTION AND VACCINATION.

These methods have been so extensively used in the experiments recorded in the earlier part of this paper that it seems unnecessary to mention them further than to remark that both are certain and reliable methods of infecting susceptible animals.

In one experiment two guinea pigs of about equal weight were vaccinated with the spleen from a guinea pig dead on the seventh day after inoculation from a naturally infected squirrel. One was vaccinated in the ordinary way, the skin being slightly abraded in the shaving; while with the other, care was taken not to injure the skin. In each case the tissue was rubbed on firmly with forceps. Both died on the sixth day with the usual lesions. An unsuccessful attempt was made to infect a guinea pig by clipping the hair with scissors instead of using the barber's clippers, and smearing the infected tissue on the surface, not rubbing it in.

INTRAPERITONEAL INOCULATION.

We have used this method but once. An emulsion of tissue from a guinea pig dead on the seventh day was injected into the peritoneal cavity of a guinea pig. The inoculated animal died on the third

day. There was no evidence of peritonitis. The liver and spleen presented the usual granular lesions. Intraperitoneal inoculation of rats has been mentioned elsewhere.

NASAL INOCULATION.

It seemed worth while determining whether the introduction of the infecting agent through the respiratory passages would give rise to lesions in the lungs. A small pledget of cotton saturated with an emulsion of spleen from a guinea pig dead on the sixth day was placed in one of the nostrils of a guinea pig. This rodent died on the sixth day with the usual lesions, the bubo being in the neck. The lungs were negative. We thought that possibly some abrasion of the nasal mucous membrane had occurred through which infection had entered that led to the formation of the cervical bubo. A second experiment was undertaken in which a drop of a liver emulsion from a guinea pig dead on the eighth day was dropped into the nostril. This guinea pig died on the sixth day and at autopsy was found to have buboes in the neck and the other usual lesions of the disease. There were no changes in the lungs beyond a few hemorrhagic points such as are occasionally seen in guinea pigs inoculated in other ways. In neither case was there evidence of pneumonia or of focal lesions in the lungs.

FEEDING EXPERIMENTS.

Two guinea pigs were fed with chopped carrots mixed with blood and viscera from an artificially infected squirrel. One died on the seventh day after the feeding, and presented the usual lesions, the bubo being in the neck; the other remained well.

We have attempted to infect but one squirrel by feeding. The viscera of a squirrel dead on the ninth day after inoculation was fed to a squirrel. This animal died eight days later. The lesions were small caseous buboes in the neck, and numerous yellowish caseopurulent masses in the mesentery. The wall of the intestine contained a few thickened yellowish patches.

Attempts to infect rats by feeding have been uniformly unsuccessful.

NATURE OF INFECTION.

Having learned something about the susceptibility of the various animals, the modes of artificial infection, and the lesions in those to which we succeeded in communicating the disease, we will now present the results of experiments having to do with the nature of the infecting agent. Although we have not been able to cultivate any organism that we regarded as etiological, certain facts bearing upon the causative agent have been demonstrated.

The nature of the lesions, an involvement of a lymph gland or a chain of lymph glands draining the site of inoculation, with focal lesions in the viscera, would lead one to suppose that the disease was, at least in some stages, due to an organism present in the blood. Mention has been made in an earlier part of the paper of the successful inoculation of animals from the heart's blood of rodents dead of the disease. We shall record here experiments in which the heart's blood was diluted, and the dilutions injected into susceptible animals, thus enabling us to determine within rather wide limits, the degree of septicæmia present.

In the first experiment, the heart's blood of a guinea pig dead on the eighth day was diluted and used a few hours after death. Each animal received the dose indicated in the table suspended in 1 c. c. of physiological salt solution.

Animal.	Weight.	Dose.	Day of death.	Lesions.
	Grams.			
Guinea pig	260	0.01 c. c. heart's blood	Fifth	Characteristic.
Do	240	0.0001 c. c. heart's blood	do	Do.
Do	220	0.000001 c. c. heart's blood	Sixth	Do.
Do	330	0.00000001 c. c. heart's blood	Tenth	Do.

In this particular instance it would appear that 0.00000001 c. c. of the blood was sufficient to convey the disease. In the next experiment the heart's blood of the guinea pig dead on the tenth day (inoculated with 0.00000001 c. c.) was used to inoculate another series of guinea pigs. The results are shown in the following table:

Animal.	Weight.	Dose.	Day of death.	Lesions.
	Grams.			
Guinea pig	300	0.001 c. c. heart's blood	Fifth	Characteristic.
Do	350	0.0001 c. c. heart's blood	Seventh	Do.
Do	480	0.000001 c. c. heart's blood	Remained well	
Do	400	0.00000001 c. c. heart's blood	do	

In this case the animals receiving less than 0.0001 c. c. were unaffected.

These experiments clearly demonstrate that the disease is due to an organism that is present in large numbers in the heart's blood after death.

DURATION OF INFECTIVENESS OF TISSUES.

Tissues have been kept in the ice box, and after varying periods used to inoculate guinea pigs. The results have not been constant, probably because the conditions have not always been similar. On one occasion tissue retained its infecting power for 18 days; in

other cases it appeared to have died out by a sojourn of 4 or 5 days in the ice box.

At room temperature in one case infectivity remained for 6 days, at which time the last inoculation was made. Tissue of the same rodent dried in the incubator for 48 hours failed to convey the disease to a guinea pig.

THERMAL DEATH POINT.

Two experiments were performed for the purpose of determining the degree of heat necessary to kill the organism that causes the disease.

An emulsion of liver of a guinea pig dead on the eighth day was used. It was found that heating it in the Arnold Sterilizer at from 60° C. to 65° C. for 5 minutes has the effect of rendering it harmless, while the control animal inoculated with the same material unheated died on the fifth day with the usual lesions. In a second experiment an emulsion made from the spleen of a guinea pig dead on the seventh day was placed in small test tubes and heated in a water bath at the temperatures stated in the following table. The emulsion was then injected into the gunies pigs with the results shown below. One cubic centimeter was the amount heated and injected in each case. The tubes were plugged with cotton and the portion containing the fluid was immersed several inches below the surface of the warm water.

Animal.	Weight.	Degree of heat.	Heat applied.	Day of death.	Lesions.
	Grams.	° *C.*	*Min.*		
Guinea pig	255	45	10	Third	Characteristic.
Do	340	50	10	Fourth	Do.
Do	290	55	10	Fifth	Do.
Do	300	60	10	Remained well	
Do	270	65	10	do	
Guinea pig (control)	330	(1)		Fifth	Characteristic.

1 Unheated.

The results of this experiment indicate a thermal death point about the same as that of most pathogenic bacteria.

EFFECT OF CERTAIN GERMICIDES.

A mixture of equal parts of salt-solution emulsion from the spleen of a guinea pig dead on the seventh day and glycerine conveyed the disease after standing 24 hours, but not after 72 hours. A mixture of the same emulsion with an equal volume of 2 per cent trikresol solution (making a 1 per cent mixture) was found free from the infecting agent after 2 minutes. No inoculations were made after a shorter exposure.

EXAMINATION OF STAINED SMEAR PREPARATIONS.

It was the absence of pest-like organisms in the first inoculated animal dead of this disease that led us to suspect that we were not dealing with plague. This is mentioned to illustrate the similarity of the lesions to plague, and the dissimilarity of stained smear preparations. Carbol-thionin, Loeffler's Alkaline Methylene Blue, Wright's stain and Giemsa's stain all usually fail to show the presence of anything that can be recognized as a micro-organism. The Ziehl-Nielson method likewise fails to show any organism. In many cases the smears show, especially in the leucocytes, fine dust-like objects which are not commonly seen in smears from the tissues of animals dead from other causes, although sufficient control work has not been done. At present we do not attach much significance to these objects, but they will be investigated more fully. Numerous very small, solid staining bacilli have been seen on a number of occasions. We can not say at present what importance should be attached to them.

CULTURAL INVESTIGATIONS.

All attempts to cultivate on artificial media the organism that causes this disease have been unsuccessful. In the great majority of cases the media remained sterile, or contained growths of what were obviously contaminating organisms. On several occasions cultures that grew on the media were used to inoculate guinea pigs, but without success in reproducing the disease. What has been said refers to aerobic cultures on agar and in broth and to liberal inoculations on the surface of agar or in broth with blood from infected squirrels and guinea pigs. Cultures in freshly steamed glucose broth in Dunham's fermentation tubes usually remained sterile, as did those in broth covered with oil. On one occasion a growth in a fermentation tube showed in smears rods and cocci. Some of the fluid from the tube was used to inoculate a guinea pig, with the result that the animal died of the disease on the ninth day. Cultures made from the guinea pig remained sterile. As the original fermentation tube had been heavily inoculated with the blood, we were inclined to attribute the death of the guinea pig to the blood in the mixture. Attempts to grow the causative organism are still being made.

FILTRATION EXPERIMENTS.

Several experiments have been made for the purpose of determining whether the cause of the disease was an organism small enough to pass through the so-called "bacteria proof" filters. The writer's experience with this class of work is so limited that he would hesitate

to report any experiments tending to show that an organism was so small as to pass through one of these filters, and consequently small enough to raise a question as to whether it might belong to the class known as ultra-microscopic organisms. However, every experiment showed that the causative agent did not pass through the Berkefeld filter. In each case control animals died of the disease in the usual time, while those inoculated with the filtrate, secured under a negative pressure of 15 pounds, remained well.

MODE OF TRANSMISSION.

Several experiments have been made for the purpose of learning the natural mode of transmission of the disease.

CONTACT.

On several occasions healthy guinea pigs and ground squirrels have been put in small cages with infected rodents, left there until the latter died and kept in the uncleaned cage for several days after the death of the sick one, but in no case was the disease transmitted even under these circumstances of intimate contact. It has been shown that feeding experiments are successful in transmitting the disease. We have good reason for believing that in nature it is not ordinarily transmitted in this manner. The reason for this is the fact that in the feeding experiments the buboes of the animals infected by ingestion were in the neck or in the mesentery, while when the disease is naturally contracted by squirrels the bubo is often situated in other parts of the body, axilla, pelvis, or inguinal regions. As the most prominent feature of the disease in most naturally infected rodents is a lesion of the peripheral lymph glands, it would seem reasonable to believe that the infection usually gains entrance through the skin. The unsuccessful contact experiments, four in number, in which healthy guinea pigs were kept with sick ones and allowed to remain in the cages, some of which were very filthy by reason of the accumulation of urine and feces from the sick and the well animals, negatived the probability that the disease was transmitted by means of contact with sick animals or their excretions.

INSECT TRANSMISSION.

It is more in keeping with our present views of the transmission of many infectious diseases to look for a living carrier, and as this disease has so many points of resemblance to plague, which has been shown to be readily transmitted among rats, guinea pigs, and squirrels by means of fleas, we naturally turned to these parasites as a probable means of conveying the disease. It was found possible to reproduce the infection in guinea pigs by subcutaneous inoculation with crushed squirrel fleas (*Ceratophyllus acutus*) taken from a squirrel or from a guinea pig dead of the disease. The successful

experiments were performed by inoculating the guinea pigs with fleas not more than 24 hours after removing them from recently dead rodents. The infection of the guinea pig in this manner proves nothing more than that the rodent from which the fleas were taken had a septicæmia. In one case in which 10 fleas were kept (alive) from 3 to 5 days before injecting them into guinea pigs, the animals remained well.

Attempts were made to infect guinea pigs and squirrels by placing the fleas, which had been removed from rodents recently dead of the disease, in clean cages with the healthy animals, and also by placing healthy rodents (squirrels and guinea pigs) in cages from which a squirrel dead of the disease had been removed. Large numbers of fleas (*C. acutus*) were present, but in no case did the animal contract the disease.

In two cases in which healthy squirrels were introduced into cages with sick animals and in the presence of large numbers of squirrel fleas (*C. acutus*) infection of the healthy rodents occurred; while in adjacent cages in which all conditions were the same, but no fleas present, the healthy animals remained unaffected.

Flea transfer No. 1 (November 11, 1910).—A squirrel was inoculated cutaneously with spleen from a naturally infected squirrel. Two healthy squirrels were placed in the cage with it and 100 fleas (*C. acutus*). The inoculated animal died on the sixth day. One of the contacts died on the nineteenth day with the usual lesions of the disease, the bubo being in the median inguinal region; the other died on the twenty-eighth day with a bubo in the axilla and other characteristic findings.

Flea transfer No. 2 (October 12, 1910).—A squirrel was vaccinated with the liver of a guinea pig dead of the disease. Two healthy squirrels were placed in the cage with this animal, together with about 500 squirrel fleas (*C. acutus*). The inoculated rodent died with the usual lesions 5 days after inoculation. The other squirrels both died, one 4 days and the other 7 days after the death of the inoculated one. In one the bubo was in the mesentery, in the other it was in the neck. On account of the location of the buboes, we were inclined to attribute the infection in these cases to ingestion rather than to flea transference.

GENERAL REMARKS.

The disease appears to be uniformly fatal to squirrels, guinea pigs, and mice. Although but few squirrels and mice were used, every one that was inoculated succumbed. Of the large number of guinea pigs used, but one survived the inoculation, and we are in doubt whether this was an example of defective technique, the absence of the infectious agent from the material used (vaccination with heart's

blood from a guinea pig), or of a natural resistance. The disease has not been observed to follow a chronic course in guinea pigs, mice, or squirrels. The time of death and the lesions indicate that the process is an acute one. The following table shows the day of death of guinea pigs inoculated by various methods:

Day of death.	Inoculation.			
	Vaccination.	Subcutaneous.	Nasal.	Intraperitoneal.
First	0	0	0	0
Second	0	0	0	0
Third	0	1	0	1
Fourth	2	1	0	0
Fifth	11	8	0	0
Sixth	21	14	2	0
Seventh	18	10	0	0
Eighth	11	1	0	0
Ninth	3	0	0	0
Tenth	1	1	0	0
Eleventh	2	1	0	0
Twelfth	1	....	....	....

The virus has been carried through eleven generations in guinea pigs without any evidence of loss of virulence.

We do not know whether the organism causing this disease is pathogenic for man, but judging from the large number of species that are susceptible, we are inclined to suspect that man might contract the infection.

SUMMARY.

A disease which presents lesions very similar to those of plague has been found among ground squirrels.

The disease is readily transmitted to guinea pigs, mice, rabbits, monkeys, and gophers, and plague-like lesions are produced in at least some of these animals. Rats are but moderately susceptible to the infection. Cats, dogs, and pigeons appear to be immune.

The disease may be transmitted artificially by subcutaneous, cutaneous (vaccination), nasal, and intraperitoneal inoculation. The mode of transmission in nature is unknown, but there is some experimental evidence that suggests that fleas may serve as carriers. The disease probably is not spread by mere contact of healthy with infected animals.

The infectious agent has not been isolated. On account of the number of species susceptible, it seems likely that it is bacterial, not protozoan.

The causative agent is present in the circulating blood, as well as in the various tissues where it causes focal lesions.

The thermal death point of the organism as it is found in the animal's body is between 55° C. and 60° C.

Several observations appear to indicate that the disease is a febrile one.

LIST OF PUBLIC HEALTH BULLETINS.

The following is a list of the Public Health Bulletins that have been issued:

*1. Report on Trichinæ and Trichinosis. By W. C. W. Glazier. 1881. 212 pages. 87 il. 1 map. Paper. Senate Executive Document No. 9, Forty-sixth Congress, third session. Out of print.

*2. Report on the Etiology and Prevention of Yellow Fever. By George M. Sternberg. 1890. 271 pages. 21 pl. 20 il. Cloth. Out of print.

3. Mortality Statistics in the United States for the year ending December 31, 1897. From Annual Report Marine-Hospital Service, 1898. 24 pages. Paper.

4. Yellow Fever: Its Nature, Diagnosis, Treatment, and Prophylaxis and Quarantine Regulations Relating thereto. By officers of the Marine-Hospital Service. Reprint from Annual Report Marine-Hospital Service, 1898. 176 pages. 1 il. Paper.

*5. Shipment of Merchandise from a Town Infected with Yellow Fever. By H. R. Carter. 1899. 15 pages. Paper. Out of print.

6. Report of Commission of Medical Officers detailed by authority of the President to Investigate the Cause of Yellow Fever. By Eugene Wasdin and H. D. Geddings. July, 1899. 98 pages. 26 charts. 2 il. Paper.

*7. The Bubonic Plague. By Walter Wyman. January, 1900. 50 pages. Paper. Superintendent of Documents, 5 cents.

*8. Report of Commission appointed by the Secretary of the Treasury for the Investigation of Plague in San Francisco. By Prof. Simon Flexner, Prof. F. G. Novy, and Prof. L. F. Barker. January 23, 1901. 23 pages. 1 map. Paper. Out of print.

*9. Report Relating to the Origin and Prevalence of Leprosy in the United States. By a commission of Medical Officers of the U. S. Marine-Hospital Service. 1902. 119 pages. 25 il. Paper. Senate Document No. 269, Fifty-seventh Congress, first session. Superintendent of Documents. Cloth, $1.00.

*10. Plague Conference. Containing a copy of the address of the chairman, and resolutions passed by a conference called in accordance with requests from a number of State Boards of Health, and under authority of section 7, act of Congress approved July 1, 1902, to consider the plague situation. Reprint from P. H. R. No. 4, Vol. XVIII, January 23, 1903. 9 pages. And February 6, 1903. 41 pages. Paper. Out of print.

11. Transactions of the First Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. June, 1903. 120 pages. Cloth.

12. Transactions of the Second Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. June, 1904. 95 pages. Cloth.

* Exhausted and not for distribution.

13. The Public Health and Marine-Hospital Service of the United States. A Brief History. Prepared for the Louisiana Purchase Exposition. December, 1904. 16 pages. Paper.
*14. Sanatorium for Consumptives, Fort Stanton, N. Mex. By P. M. Carrington. Reprint from Annual Report Public Health and Marine-Hospital Service, 1904. 19 pages. Paper. Out of print.
15. Transactions of the Third Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. May, 1905. 52 pages. Cloth.
16. How to Prevent Yellow Fever—No Mosquitoes, No Yellow Fever. By Walter Wyman. July 31, 1905. 3 pages. Circular.
17. Transactions of the Fourth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. May, 1906. 75 pages. Cloth.
18. Transactions of the Fifth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. May, 1907. 47 pages. Cloth.
19. Trachoma, Its Character and Effects. By Taliaferro Clark and J. W. Schereschewsky. 1907. 34 pages. 6 ll. Paper.
*20. The Public Health and Marine-Hospital Service of the United States. A Brief History. Prepared for the Jamestown Ter-Centennial Exposition. 1907. 12 pages. Paper. Out of print.
21. Transactions of the Sixth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. April, 1908. 79 pages. Cloth.
*22. The Present Pandemic of Plague. By J. M. Eager. 1908. 30 pages. Paper. Out of print.
23. Pellagra—A Precis. By C. H. Lavinder. July 24, 1908. 22 pages. 1 il. Paper.
24. The Marine-Hospital Sanatorium, Fort Stanton, N. Mex. Prepared for the International Congress on Tuberculosis, held in Washington, September, 1908. 32 il. 56 pages. Paper.
*25. Hookworm Disease. Reprint from Annual Report P. H. and M. H. S., 1908. 5 pages. Paper. Out of print.
26. Studies upon Leprosy.
    I. The Present Status of the Leprosy Problem in Hawaii.
    II. The Reaction of Lepers to Moro's "Percutaneous" Test.
    III. A Note Upon the Possibility of the Mosquito Acting in the Transmission of Leprosy. By W. R. Brinckerhoff. 1908. Investigations made in accordance with the Act of Congress approved March 3, 1905. 24 pages. Paper.
27. Studies upon Leprosy.
    IV. Upon the Utility of the Examination of the Nose and the Nasal Secretions for the Detection of Incipient Cases of Leprosy. By W. R. Brinckerhoff and W. L. Moore. 1909. Investigations made in accordance with the Act of Congress approved March 3. 1905. 29 pages. Paper.
28. Studies upon Leprosy.
    V. A Report upon the Treatment of Six Cases of Leprosy with Nastine (Deycke). By W. R. Brinckerhoff and J. T. Wayson, Honolulu, T. H.

* Exhausted and not for distribution.

28. Studies upon Leprosy—Continued.
    VI. Leprosy in the United States of America in 1909. By W. R. Brinckerhoff. 1909. Investigations made in accordance with the Act of Congress approved March 3, 1905. 25 pages Paper.
29. The Prevalence of Rabies in the United States. By J. W. Kerr and A. M. Stimson. 1909. 16 pages. Paper.
30. The Rat and its Relation to the Public Health. By various authors. 1910. 254 pages. 60 figs. 6 pls. Paper.
    1. Introduction. By Walter Wyman.
    2. Natural History of the Rat. By D. E. Lantz.
    3. Plague Infection in Rats. By G. W. McCoy.
    4. Rat Leprosy. By. W. R. Brinckerhoff.
    5. Bacterial Diseases of the Rat other than Plague. By D. H. Currie.
    6. Organic Diseases of the Rat. By G. W. McCoy.
    7. Ecto Parasites of the Rat. By N. Banks.
    8. Intestinal Parasites of Rats and Mice in their Relation to Diseases of Man. By C. W. Stiles.
    9. Rodents in Relation to the Transmission of Bubonic Plague. By Rupert Blue.
    10. Rodent Extermination. Rats and Mice. By W. C. Rucker.
    11. Natural Enemies of Rats. By D. E. Lantz.
    12. Rat-Proofing as an Antiplague Measure. By R. H. Creel.
    13. Inefficiency of Bacterial Viruses in the Extermination of Rats. By M. J. Rosenau.
    14. Plague Eradication in Cities by Section Extermination of Rats and General Rat-Proofing. By Victor G. Heiser.
    15. The Rat in Relation to Shipping. By W. C. Hobdy.
    16. The Rat as an Economic Factor. By D. E. Lantz.
    17. The Rat in Relation to International Sanitation. By J. W. Kerr.
31. Transactions of the Seventh Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. June, 1909. 86 pages. Cloth.
32. Hookworm Disease (or Ground-Itch Anemia), its Nature, Treatment, and Prevention. By Prof. C. W. Stiles. 1910. 40 pages. Paper.
33. Studies upon Leprosy. 1910. 25 pages. Paper.
    VII. A Statistical Study of an Endemic Focus of Leprosy. By W. R. Brinckerhoff and A. C. Reinecke.
    VIII. A Palliative Treatment for Leprous Rhinitis. By J. T. Wayson and A. C. Reinecke.
34. Maritime Quarantine. By L. E. Cofer. 1910. 25 figs. 64 pages. Paper. Appendix: Disinfectants Authorized by United States Quarantine Regulations and the Proper Method of Generating and Using Same.
35. The Relation of Climate to the Treatment of Pulmonary Tuberculosis. By F. C. Smith. 1910. 17 pages. Paper.
36. Tuberculosis: Its Nature and Prevention. By F. C. Smith. 1910. 12 pages. 1 plate. Paper.
37. The Sanitary Privy: Its Purpose and Construction. By Prof. C. W. Stiles. 1910. 24 pages. 12 figs. Paper.
38. General Observations on the Bionomics of the Rodent and Human Fleas. By M. B. Mitzmain. 1910. 34 pages. Paper.
39. Studies upon Leprosy. September, 1910. 50 pages. Paper.
    IX. Mosquitoes in Relation to the Transmission of Leprosy.
    X. Flies in Relation to the Transmission of Leprosy. By D. H. Currie.
    XI. Heredity Versus Environment in Leprosy. By H. T. Hollmann.

40. Transactions of the Eighth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. November, 1910. 101 pages. Paper.

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43. I. Studies upou Plague in Ground Squirrels. II. A Plague-like Disease of Rodents. By George W. McCoy. February, 1911.

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FIG. 1 – BUBO: ACUTE PLAGUE IN GROUND SQUIRREL.

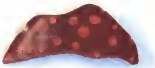

FIG. 2.– SPLEEN: SUBACUTE PLAGUE IN GROUND SQUIRREL. SMALL CASEOUS FOCI.

L. H. Wilder, del.

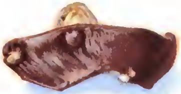

Fig. 3.–Spleen, Subacute Plague in Ground Squirrel.
large and small caseous foci.

Fig. 4–Spleen: Subacute Plague in Ground Squirrel
single large abscess

I. H. Wilder del.

FIG 5.—SUBACUTE PLAGUE IN GROUND SQUIRREL.
DIFFUSE CONSOLIDATION OF LUNGS.

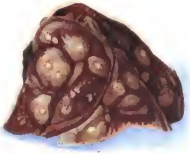

FIG 6 – SUBACUTE PLAGUE IN GROUND SQUIRREL
LARGE AND SMALL ABSCESSES IN LUNGS.

L. H. Wilder [illegible]

FIG. 7.—SUBACUTE PLAGUE IN GROUND SQUIRREL.
SMALL ABSCESSES IN LUNGS.

FIG 8 — RESIDUAL PLAGUE BUBO.

L. H. Wilder del. BREUKER & KESSLER CO. PHILADA.

FIG 9 – BUBO, PLAGUE LIKE DISEASE IN GUINEA PIG

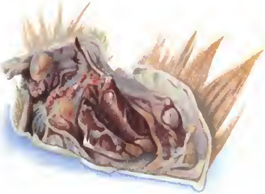

FIG 10 – BUBO PLAGUE IN GUINEA PIG

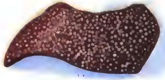

Fig. 11.—Spleen of Squirrel, Plague-like Disease

Fig 12 – Liver of Guinea Pig. Plague-like Disease.

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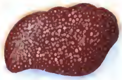

FIG 13.—SPLEEN OF GUINEA PIG. PLAGUE-LIKE DISEASE.

FIG. 14.—LIVER OF GUINEA PIG PLAGUE.

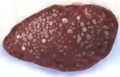

FIG 15.—SPLEEN PLAGUE IN GUINEA PIG

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ACUTE ANTERIOR POLIOMYELITIS

(*Infantile paralysis*)

A PRÉCIS

BY

WADE H. FROST
Passed Assistant Surgeon

PREPARED BY DIRECTION OF THE SURGEON GENERAL

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CONTENTS.

ACUTE ANTERIOR POLIOMYELITIS.
(INFANTILE PARALYSIS.)

By Wade H. Frost,
Passed Assistant Surgeon United States Public Health and Marine-Hospital Service.
[From the Hygienic Laboratory.]

INTRODUCTION.

Few diseases present a more complex problem than does acute anterior poliomyelitis. Eminent specialists in diseases of the nervous system, general pathology, experimental biology, orthopedic surgery, pediatrics, and epidemiology have all found in this disease special problems in their respective fields of research. The record of their special researches makes an extensive and exhaustive literature, dealing with the problem from many points of view. This literature is, however, widely scattered at present, partly because much of it is too technical to be of interest except to those engaged in some special field, partly because the bulk of the best of it is still too recent to have found its way into reference books in general use.

The object of this paper is to present, in abstract, such essential facts of the disease as may be of use, especially to the busy general practitioner to whom much of the recent literature is unavailable, to give him a general idea of the problem, and more specifically to aid him in his all-important rôle in the campaign of prevention, viz, the early recognition of cases. For those who care to go more deeply into the subject a classified bibliography is appended, referring to such of the more important special articles on various aspects of the disease as are most easily available.

For obvious reasons no attempt is made here to give a review of all the literature on the subject. Only such articles have been selected as seemed best suited, by reason of their originality, accuracy, or comprehensiveness, to the purpose of this paper.

Free use has been made of the report of the Collective Investigation Committee of New York on the epidemic of 1907,[1] the report of special investigators to the Massachusetts State Board of Health,[2] the works of Flexner and Lewis, and various other articles. I am especially indebted to Wickman's[3] extensive work, which, although written before the experimental demonstration of the infectious nature of acute anterior poliomyelitis, remains in many respects, especially in its clinical descriptions, the most comprehensive and satisfactory treatise on the subject. This work has been freely quoted and given preference over other clinical works because it is the result of the most extensive study of the disease ever made by an individual. In fact, it is doubtful if anything essential to our clinical knowledge of the disease, except statistical data and occasional reports of rare cases, has been added to Wickman's observations. Most of the reports made since his writing have been confirmations of his accuracy and comprehensiveness. A translation of Wickman's work, especially the clinical section, would be of great benefit to the physicians of the country.

SYNONYMS.

The term "acute anterior poliomyelitis," indicating as it does an acute inflammation characteristically localized in the *anterior cornua of the gray matter* of the spinal cord, is not an altogether satisfactory designation for the disease under consideration, for it has been amply demonstrated that the lesions are not confined to that area of the cord, and not necessarily confined even to the spinal cord. It is desirable, however, for the sake of uniformity and precision in mortality and morbitity reports to have one term in general use. The Bureau of the Census has experienced considerable difficulty in the compilation of mortality statistics for this disease by reason of the numerous designations employed. The returns for 1909 were received under 24 different designations.[4] The Bureau of the Census urges, therefore, with good reason, the uniform adoption of the term "acute anterior poliomyelitis." The term "infantile paralysis" is objectionable, because it is hardly applicable to adult cases; also, because it is likely to be confused with other infantile paralyses of altogether different etiology. Other terms in general use are "acute

[1] Epidemic poliomyelitis: Report of the Collective Investigation Committee on the New York Epidemic of 1907. Nervous and Mental Diseases, monograph, series No. 6, New York, 1910.

[2] Lovett, Robt. W.: The Occurrence of Infantile Paralysis in Massachusetts in 1909. Boston Med. and Surg. Jour., 1910, vol. 163, pp. 37–55.

[3] Wickman, Ivar: Beiträge zur Kenntniss der Heine-Medinschen Krankheit (Poliomyelitis acuta und verwandter Erkrankungen). Berlin, 1907. S. Karger.

[4] Mortality statistics, 1909. Department of Commerce and Labor, Bureau of the Census, Bull. 108, Washington, 1910, p. 25.

poliomyelitis," "epidemic poliomyelitis," "acute spinal paralysis," "acute atrophic spinal paralysis," "essential paralysis," and a number of other variations.

HISTORICAL.

Acute anterior poliomyelitis is not, in any sense, a "new disease." Mitchell [1] found in the skeleton of an Egyptian mummy, dating back to 3700 B. C., evidence of probable poliomyelitis. Jacob von Heine [2] is generally credited with having given, in 1840, the first clear clinical description and differentiation of the affection. He was not, however, the first to mention the disease. Underwood,[3] in 1774, gave a recognizable, though by no means clear-cut, description; and doubtless still other references may be found in early medical literature.

EPIDEMIC PREVALENCE.

The epidemic occurrence of poliomyelitis has been recognized more recently. Colmer [4] records the occurrence of an epidemic of paralysis among teething infants in Louisiana in 1841. He did not identify the epidemic with the disease described by Von Heine. Bergenholz [5] is credited with being the first to recognize an epidemic of poliomyelitis, in 1881; his observations, however, were not published until 1890, when Medin made them known. Oxholm [6] and Cordier [7] had each in the meantime observed a small epidemic, but their publications attracted little attention until Medin [8] brought them to light in 1890, at the same time reporting his own observations on an epidemic of 43 cases which occured in and around Stockholm in 1887. Since that time epidemics have been observed with increasing frequency in various parts of the world. The largest epidemics recorded have been as follows: In Vermont, 1894, 126 cases; Norway and Sweden, 1905, about 1,500 cases; New York City and vicinity, 1907, about 2,500 cases.

From 1907 to 1910 outbreaks have occurred in the following States in this country: Connecticut, 1910; District of Columbia, 1910; Florida, 1907; Illinois, 1909; Iowa, 1908–1910; Kansas, 1909–10; Massachusetts, 1907, 1908, 1909, 1910; Michigan, 1907–8, Minnesota, 1908, 1909, 1910; Missouri (?), 1908; Nebraska, 1909; New York,

[1] Mitchell, J. K., Trans. Assn. Am. Physicians, vol. 15, 1900, pp. 134–136.

[2] Von Heine, Jacob, Spinale Kinderlähmung, II Aufl., Stuttgart, 1860, J. G. Cotta. (First ed. pub. in 1840.)

[3] Underwood, Michael: Treatise on the diseases of children. Phila., 1893, F. Dobson.

[4] Colmer, George: Medical Notes: Paralysis in teething children. Am. Jour. Med. Sci., 1843, vol. 5, p. 248.

[5] Cited by Medin. Verhandl. d. X. Internat. med Kongr., Berlin, 1890. II Abt., VI, 1891.

[6] Cited by Leegard. Neurol. Centralblatt, 1890, p. 760.

[7] Lyon Méd., 1888, vol. 57, 5; 48.

[8] Medin. Verhandl. d. X. Internat. med. Kongr., 1890. II Abt., VI, Berlin, 1891.

1907, 1910; Oregon. 1910; Pennsylvania, 1910; South Dakota, 1910; Virginia, 1908–1910; Washington, 1910; Wisconsin, 1908. Since 1907 epidemics have also occurred in Canada, in various parts of Germany and Austria, in Cuba, and in the island of Nauru, in Melanesia (1910).

Since the severe outbreak in Norway and Sweden in 1905, epidemic poliomyelitis has prevailed more widely than ever before. Whether or not this pandemic may be attributed to a spread of infection from Scandinavia is a question still open to dispute, the discussion of which is beyond the scope of this paper. Lovett's[1] compilation of the reported epidemics since 1881, is as follows:

Years.	Cases.	Outbreaks.	Average number of cases.
1880–1884	23	2	11.5
1885–1889	93	7	13
1890–1894	151	4	38
1895–1899	345	23	15
1900–1904	349	9	39
1905–1909	8,054	25	322

These figures show very strikingly the enormous increase in the epidemic prevalence of poliomyelitis from 1905 to 1909. There is good reason to believe that there has been a corresponding increase during the same period, in so-called "sporadic" cases—cases which are not recognized as occurring in connection with any well-defined epidemic. This is inferred from hospital reports, showing a large increase in the number of patients admitted for treatment for the resulting paralysis, in districts where no epidemic has been reported.

Lovett calls attention to the fact that the United States has suffered more severely than any other country, being credited with some 5,500 of the 8,000 cases reported from 1905 to 1909. It will be noted, too, that the great majority of epidemics in the United States have occurred in the northern States, east of the Dakotas. While reports for 1910 are as yet incomplete, it may safely be asserted that the prevalence of the disease has very considerably increased during this year, in respect both to the number of persons attacked and the area over which the epidemics have occurred.

According to the statistics of the Census Bureau,[2] there were 569 deaths from acute anterior poliomyelitis in the registration area of the United States in 1909. The population from which these statistics are collected represents 55.3 per cent of the total population of the United States. The 569 deaths reported are from 33 States, and do not include a considerable number of deaths in nonregistration States, notably in Minnesota and Nebraska.

[1] Lovett, Robt. W., Bost. Med. and Surg. Jour., July 14, 1910, vol. 163, No. 2, pp. 37–55.
[2] Mortality statistics, 1909. Department of Commerce and Labor, Bureau of the Census, Bull. 108, Washington, 1910, pp. 24–26.

It naturally follows that the increased prevalence of epidemic poliomyelitis, with the consequent stimulation of interest therein, should have resulted in many valuable additions to our knowledge of the subject.

Pathology.—Jacob von Heine,[1] as above stated, first gave a clear-cut clinical description of acute anterior poliomyelitis in 1840. Prevost and Vulpian,[2] in 1865, are credited with having given the first anatomical demonstration of the destruction of the ganglion cells of the anterior cornu in poliomyelitis. The clinical studies of Von Heine and the pathological studies of Prevost and Vulpian both dealt with the late manifestations of the disease as seen subsequent to the acute stage. Roger and Damaschino,[3] in 1871, reported the first pathological study of a cord from a case in the acute stage; and first recognized interstitial changes as the *primary* lesions of acute poliomyelitis. From that time ensued a running fight among pathologists in regard to pathogenesis, one school holding the essential acute lesion to be specific intoxication of the motor cells of the anterior cornu, the interstitial changes being of secondary importance. The other school deemed the primary essential lesion in the acute stage to be a diffuse myelitis, resulting secondarily in degenerative changes of the motor ganglion cells. With the increase of the epidemic prevalence of poliomyelitis and the increased opportunities for the study of material obtained from recent acute cases, it has become more and more evident that the views of the latter school were correct; and it is now generally recognized that the acute nervous lesions of poliomyelitis are interstitial and widespread throughout the cerebrospinal axis. While many pathologists have had a part in this demonstration, special credit should be given to Wickman[4] and to Harbitz and Scheel.[5]

Symptomatology.—Parallel with the development of knowledge of the pathology of the disease has been the development of the knowledge of its clinical manifestations. Medin,[6] in 1890, gave the first comprehensive account of the symptoms of the acute stage from observations of an epidemic in Stockholm in 1887. He was the first to call attention forcibly to the varied clinical manifestations of the acute stage, indicative of changes in all parts of the nervous system,

[1] Von Heine, Jacob. Spinale Kinderlähmung.

[2] Prevost and Vulpian: Observation de la paralysis infantile. C. R. de la Soc. de Biol., 1865. Paris, 1866, 4 s., ii, pp. 215–218.

[3] Roger and Damaschino: Recherches anatomo-pathologiques sur la paralysie spinale de l'infance. C. R. de la Soc. de Biol., 1871. Paris, 1873, 5 s., iii, pt. 2, pp. 49–93.

[4] Wickman, I.: Studien über Poliomyelitis actua. Arb. aus d. Path. Inst. d. Univ. Helsingfors, 1905–1907. Berlin, 1907, S. Karger, pub.

[5] Harbitz u. Scheel: Pathologisch-anatomische Untersuchungen über akute Poliomyelitis u. verwandter Erkrankungen. Christiania, 1907, A. W. Broggers, pub.

[6] Medin, loc. cit.

although Strümpell[1] and Pierre-Marie[2] had previously noted the occurrence of encephalitis in acute poliomyelitis, and others had, in a less comprehensive manner than Medin, noted many of the facts which he first put together so clearly. In view of the pioneer services of von Heine in describing the later stages and of Medin in describing accurately the acute stage, Wickman has suggested the name "Heine-Medin disease" for acute poliomyelitis, since pathological designations (acute anterior poliomyelitis, acute poliomyelitis, epidemic poliomyelitis, epidemic spinal paralysis, infantile paralysis, poliomyelo-meningo-encephalitis) are either misnomers or overcumbersome. The most valuable clinical contribution since Medin's has been made by Wickman, whose special service in this respect has been the recognition of abortive forms of the disease, and the presentation of the whole subject from a broader, more comprehensive point of view than any of his predecessors.

Epidemiology.—The recognition of the epidemic occurrence of the disease has already been referred to as dating from the observations of Bergenholz, in 1881. While many observers since Bergenholz have reported epidemics of acute poliomyelitis, and in many cases have gone more or less into the question of the origin and transmission of the epidemics, the first systematic study from an epidemiologic point of view was undertaken by Wickman in Sweden in 1905–6. He personally investigated over 1,000 cases, attempting to trace the routes by which the disease spread. He found abundant evidence to show that it was contagious, though usually slightly so. He directed especial attention to several factors in its spread—routes of travel, public gatherings of children (schools), abortive (ambulant) cases, and healthy intermediate carriers. Since that time systematic epidemiologic investigations have been undertaken by the Governments of several foreign countries; and in this country by several States, notably Massachusetts, Minnesota, Nebraska, Kansas, and Iowa. A committee of the New York Neurological Society investigated and has recently reported upon the New York epidemic of 1907. The reports of the New York investigation committee and of the Massachusetts State Board of Health are especially valuable, on account of their comprehensiveness and thoroughness.

Experimental poliomyelitis.—The most recent development of knowledge concerning epidemic poliomyelitis is derived from the study of the disease experimentally produced in monkeys. It had been recognized for some years prior to 1909 that acute poliomyelitis must be due to some specific infection; and quite a number of observers had isolated from the nervous system of patients suffering from the disease bacteria which they believed to be the specific causa-

[1] Strümpell, Jahrb. f. Kinderheilk., 1885.

[2] Pierre-Marie, Progrès méd., 1885, II, s., II, 167–169.

tive agent. Some observers claimed to have reproduced the disease in lower animals by injections of pure cultures of such bacteria. However, the bacteria found by different observers belonged to different species; many competent bacteriologists constantly failed to find any bacteria whatsoever, and the lesions occasionally produced in lower animals did not correspond to the lesions of human poliomyelitis. Consequently, none of the above claims were generally accepted. In the spring of 1909, Landsteiner and Popper [1] succeeded in transmitting the disease to two monkeys by inoculation with the spinal cord of a child which had died of acute poliomyelitis. The lesions found in the cords of these monkeys were typical, but Landsteiner and Popper failed in their attempts to transmit the disease from these to other monkeys. Later in the year Flexner and Lewis [2] succeeded in confirming the work of Landsteiner and Popper, and further succeeded in transmitting the infection from monkey to monkey through an indefinite number of passages. Since then a great deal of very brilliant experimental work has been done upon this subject by Flexner and Lewis, Römer and Joseph, Landsteiner and Levaditi, Leiner and Weisner, Krause and Meinecke, R. Kraus, and others.[3]

ETIOLOGY.

THE SPECIFIC ORGANISM.

The proof that the causative agent of epidemic poliomyelitis is a *living organism* is furnished by its demonstrable multiplication or *reproduction* in the body of an inoculated animal, reproduction being a property confined to living organisms. A comparatively small amount (0.5 c. c. of a 5 per cent emulsion) of the spinal cord of a person who has died of epidemic poliomyelitis, injected into the brain of a monkey, is sufficient to produce the disease in this animal after an incubation period of 5 to 46 days. This effect might be ascribed to the action of either a living organism, capable of multiplication or a chemical poison (toxin). In the latter case, the toxin must undergo great dilution, since portions of the central nervous system of this animal, remote from the site of inoculation, have been found capable of reproducing the disease in other monkeys. After a very few such passages the amount of toxin contained in, say, 1 gram of the spinal cord would be inconceivably small, and the potency of the cord in causing the disease proportionately diminished. As a matter of fact, Flexner and Lewis [4] have succeeded in transmit-

[1] Landsteiner, K., and Popper, E. Zeitschr., f. Immunitätsforsch, usw., Orig., 1909, vol. 2, p. 377.

[2] Flexner, S., and Lewis, Paul A., Jour. Am. Med. Assn., 1909, vol. 53, p. 1639.

[3] The more important works of all these authors are cited by Lovett in Boston Med. and Surg. Jour., vol. 163, 1910, pp. 37–55, and by Landsteiner and Levaditi in Ann. de l'Inst. Pasteur, vol. 24, 1910, pp. 833–876.

[4] Flexner, S., Journ. Am. Med. Assn., vol. 55, pp. 1105–1113.

ting the disease through a series of at least 25 monkeys, using at times quantities of the virus as small as 0.01 c. c. to 0.001 c. c.

From one monkey, inoculated with a minimal dose of the virus, enough virus can be obtained to reproduce the disease in *several hundred* monkeys. The multiplication of the virus in 25 passages is, therefore, enormous.

In spite of the fact that this organism can not be isolated in pure culture, as can the bacteria, a great deal of quite definite knowledge concerning it has already been acquired by the work of the above-mentioned observers.

It is known to be an exceedingly small organism, because emulsions of virulent spinal cord are still infective after filtration through very dense porcelain (Chamberland) filters, the pores of which are so small that even very minute *bacteria* can not pass through. The organism belongs, therefore, to the class of so-called "filterable viruses," other examples of which are the organisms of yellow fever, rabies, the foot-and-mouth disease of cattle, probably hog cholera, and others.

It is not visible in preparations made by the usual bacteriologic methods, but is thought to have been seen with high-power lenses in preparations very carefully stained; also unstained, by the use of dark-background illumination. It will not grow upon the ordinary culture media in general use for cultivating bacteria, but will probably multiply to a slight extent in ascitic bouillon. Such cultures have been successfully transplanted, but are not virulent and are of little practical value in experimental studies.

The virus of poliomyelitis is killed by a temperature of 45°–50° C. in half an hour; also, by comparatively weak disinfectants, such as 1:500 solution of permanganate of potash;[1] 1 per cent menthol in oil;[1] a powder containing menthol 0.5, salol 5, and boric acid 20;[1] a dilution of perhydrol (Merck) equivalent to 1 per cent of peroxide of Hydrogen.[2,3]

It is not destroyed by very low temperatures nor by drying over caustic potash or in vacuo for a considerable period. A virulent cord has been kept for almost five months in pure glycerin without losing its virulence, resembling in this respect the virus of rabies, vaccine, etc., and differing from nonspore-bearing pathogenic *bacteria*, which are, for the most part, killed by pure glycerin in a short while.

As is to be expected, the organism is present in greatest abundance in the spinal cord of infected persons and animals, as shown by the extremely small amounts of these organs necessary to infect a monkey

[1] Landsteiner, K., and Levaditi, C., Ann. de l'Inst. Pasteur, 1910, vol. 24; pp. 833–876.

[2] Flexner, S., and Lewis, Paul A., Journ. Am. Med. Assn., vol. 56, 1910, p. 1782.

[3] The ordinary commercial preparation of hydrogen peroxide contains about 3 per cent of the peroxide (H_2O_2). Perhydrol (Merck) contains about 30 per cent H_2O_2.

by inoculation (0.001 c. c. to 0.01 c. c. of an emulsion of cord—Flexner). It is also, however, quite constantly present in the brain and has been demonstrated in various other organs of infected animals, viz, in the mucous membrane of the nose and pharynx, the salivary glands, the mesenteric glands, the regional (axillary or inguinal) lymph glands after subcutaneous inoculation, in the blood, and in the cerebro-spinal fluid. In the blood, however, the virus appears to be present in small quantity and only in the early stages of the disease, and the same may be said of the cerebro-spinal fluid. No one has yet succeeded in demonstrating the presence of the virus in the urine or feces, though it is suspected, from the pathology of the disease, that the feces may be infectious, and technical difficulties may explain the failure to demonstrate this.

The most uniformly successful method of inoculating monkeys is by injecting an emulsion of infectious material directly into the central nervous system, preferably into the brain. Monkeys may also be infected by subcutaneous, intraperitoneal and intravenous inoculation, by rubbing virulent material into the scarified mucous membrane of the nose, by transplantation of infectious tissue into the trachea, and by introducing the virus into the stomach along with an opiate to restrain peristalsis. Leiner and Weisner[1] have infected monkeys through the *uninjured* nasal mucous membrane. This is, however, an uncertain method of inoculation, as other observers have failed in their attempts to reproduce the disease in this way. Monkeys have so far never been known to contract the disease spontaneously from intimate association with infected monkeys.

Numerous attempts have been made to transmit the disease to lower animals other than the monkey, viz, to guinea pigs, rabbits, horses, sheep, hogs, dogs, cats, chickens, ducks, and pigeons. These animals have all been found insusceptible, with the exception of certain breeds of rabbits. Krause and Meinicke[2] were the first to report the successful inoculation of rabbits from human material, and subsequent transmission from rabbits to other rabbits and to monkeys. Their results have been confirmed to some extent by other workers[3] who have succeeded in producing in a comparatively small proportion of rabbits inoculated, a disease which has more or less clinical resemblance to acute poliomyelitis. Landsteiner and Levaditi[3] found in the cord of one of their rabbits lesions similar to those found in man and in the monkey. Others have failed to find such

[1] Leiner, C., and Weisner, R. v., Wien. klin. Wochenschr., 1910, vol. 23, p. 323.

[2] Krause, R., and Meinicke, E., Deutsche med. Wochenschr., 1910, vol. 35, p. 647; ibid., 1910, vol. 35, p. 1825.

[3] Beneke, Münch. med. Woch., 1910, vol. 57, pp. 176–178; Krans, R., Med. Klin., 1910, vol. 6, pp. 470–472; Landsteiner, K. and Levaditi, C., Ann. de l'Inst. Past., 1910, vol. 24, pp. 833–876; Bonhof, Münch. med. Woch., 1910, vol. 57, p. 105; Dahm, Münch. med. Woch., 1909, vol. 56, p. 2553; Lentz and Hüntemuller, Tag. der fr. Verein. Mikrobiol., Berlin, 1910 (cited by Landsteiner and Levaditi, supra).

lesions; and indeed the great majority of attempts to inoculate rabbits have proved unsuccessful. The question of the susceptibility of rabbits to human infection has not been sufficiently cleared up to warrant very definite conclusions. It appears, however, that they are at least very much less susceptible than monkeys.

IMMUNITY.

Monkeys which have recovered from the infection of poliomyelitis show a definite immunity, demonstrable in two ways: (1) They are not susceptible to infection by reinoculation, and (2) their blood serum, when mixed in suitable proportions with an emulsion of virulent spinal cord and allowed to stand for several hours, renders the virus harmless. This property has also been demonstrated in the blood of persons who have recovered from poliomyelitis, but is not shown by the blood of normal persons and of normal monkeys.

The immunity is probably very lasting. The neutralizing power of the blood has been shown to last for 3 years after an attack of poliomyelitis, but was found absent in one case tested 11 years after the acute attack.[1] A second attack of the disease is rare, but a few instances have been reported of recurrence after the lapse of several years.

It has not been found possible as yet to obtain from immunized animals a serum which will arrest the progress of the disease after it has developed. While the hope of such a serum may still be held out as a possibility, its usefulness would necessarily be limited to the treatment of the early stages of the disease, before destruction of nerve centers had taken place. Attempts to actively immunize (vaccinate) monkeys have, in some instances, been successful, but no method has yet been developed which may safely be applied to human beings.

CONTAGIOUSNESS.

It has been experimentally demonstrated that the *mucous membrane* of the nose of infected monkeys is infectious, and in one case the salivary glands;[2] and it has been quite reasonably inferred therefrom that the *secretions* of the nose and mouth are infectious, although experiments aiming to demonstrate the latter have failed.[3] It has also been shown that infection may take place through the mucous membrane of the respiratory and digestive tracts.

These facts indicate very strongly that the disease is transmissible directly from person to person by direct contact, a conclusion which

[1] Netter, A., and Levaditi, C., Comp. rend. de la Soc. de Biol. 1910, vol. 68, pp. 855–857.
[2] Landsteiner, K., and Levaditi, C., Comp. rend. de la Soc. de Biol. 1909, vol. 67, p. 788.
[3] Landsteiner, K., and Levaditi, C., Comp. rend. de la Soc. de Biol. 1909, vol. 67, p. 788, 833–876.

Wickman had already reached from his epidemiologic studies. Others have reached varying conclusions from the study of epidemics, some asserting that there was no evidence that contact with the sick played any rôle in the transmission of the disease, some considering its contagiousness established. While it is beyond the scope of this paper to discuss in detail the evidence for and against the contagiousness of epidemic poliomyelitis, it may be said that the best evidence at present available indicates that the disease is *transmissible* from person to person, probably by direct contact. It must be usually rather slightly transmissible, since only a small proportion of persons in intimate contact with cases contract the disease. Under some circumstances, however, it appears to be rather highly contagious, affecting a very considerable proportion of the population of a limited area. Examples of seemingly quite contagious epidemics are reported by Wickman, from Traestena, Sweden; by Shidler,[1] from Polk County, Nebr.; and by Armstrong,[2] from North St. Paul, Minn. The writer investigated a small, apparently highly contagious outbreak among the attendants of a rural school in Hancock County, Iowa, in the summer of 1910, details of which will be given in a later publication.

OTHER ETIOLOGICAL FACTORS.

It is evident that certain predisposing factors are operative in causing infection, either by increasing the susceptibility of persons exposed, by increasing the virulence of the infecting organism, or by facilitating its transmission.

Geographic distribution.—Epidemics of poliomyelitis have been most prevalent in the northern parts of Europe and of the United States, and, more recently, also in Canada. The disease has not been confined to these countries, however. Epidemics have occurred in southern Europe (Italy) and in the southern part of the United States (Alabama, South Carolina, and Virginia); a considerable epidemic occurred in Cuba in 1909. There have been several epidemics in Australia, and during January, 1910, a very remarkable epidemic on the little island of Nauru, situated near the Equator, north of Australia. There are, therefore, no well-defined geographic limits to the area within which acute poliomyelitis has been known to become epidemic. Sporadic cases, not known to be connected with epidemic outbreaks, have occurred over a still wider area.

The occurrence of epidemics in various places has not been proportional to their geographic proximity to recognized previous epidemic foci, nor has it apparently been proportional to the amount of travel from such foci. It appears, however, that sporadic cases

[1] Shidler, G. P., Pediatrics, vol. 22, 1910, pp. 539–543.
[2] Armstrong, J. M., Pediatrics, vol. 22, 1910, pp. 486–501.

are unusually prevalent along routes of travel leading from epidemic foci.

Density of population.—The occurrence and spread of epidemic poliomyelitis is not proportional to the density of population. On the contrary, epidemics have been more severe and the case rates have been higher in small towns and rural districts than in the more densely populated cities, and in cities the disease has not been found more prevalent in the crowded districts.

Climate.—The countries which have suffered most have been those with a cold climate, showing marked seasonal variations in temperature, but striking exceptions to this have been noted above.

Season.—Epidemics of acute poliomyelitis occur almost invariably in the warm, dry months—in the Northern Hemisphere from May to November; in the Southern Hemisphere from November to May. Sporadic cases occur, however, throughout the year, and warm weather need not therefore be considered a *necessary* factor in infection.

Age.—The proportion of cases decreases progressively in each decade after the first. The proportion of adult cases, however, may be considerable in epidemics. The great variations in the age incidence in different epidemics are illustrated in the following tables, the first of which is arranged in three-year periods, in order to include Wickman's statistics, while the second is arranged in the more usual five-year periods. The majority of cases are in children between 1 and 5 years of age.

THREE-YEAR PERIODS.

Ages.	Reported by—							
	Collective investigation committee, New York (1907).		Lovett, Massachusetts (1909).		Hill, Minnesota (1909).		Wickman, Sweden (1905).	
	No. of cases.	Per cent of total.	No. of cases.	Per cent of total.	No. of cases.	Per cent of total.	No. of cases.	Per cent of total.
0-2, inclusive	463	63.5	258	41.9	89	27.4	169	19.5
3-5, inclusive	197	27.0	182	29.6	90	27.7	181	21.1
6-8, inclusive	40	5.5	70	11.4	53	16.3	154	17.6
9-14, inclusive	21	2.9	57	9.3	47	14.5	165	19.0
15 and over	8	1.1	48	7.8	46	14.2	199	22.9
Total cases	729	....	615	....	325	....	868	....

FIVE-YEAR PERIODS.

Under 1 year	62	8.5	44	7.2	21	6.5	....	....
1-5 years	598	82.0	396	64.5	158	48.6	....	....
6-10 years	47	6.4	98	15.9	77	23.7	....	....
11-15 years	14	1.9	31	5.0	25	7.7	....	....
16-20 years	5	.68	15	2.4	21	6.5	....	....
Over 20 years	3	.40	31	5.0	23	7.0	[1] 87	[1] 10.0
Total cases	729	....	615	....	325	....	868	....

[1] Wickman's figures are given only in three-year periods and are therefore available only for the last columo of this table.

The New York epidemic of 1907 is characterized by the large percentage of cases occurring in childhood (90.5 per cent in the first six years) while the Swedish epidemic of 1905 stands at the other extreme, with only 40.6 per cent of cases in the first six years, and 10 per cent among *adults*. The epidemics in Massachusetts and Minnesota are intermediate between these two extremes, the Minnesota statistics approximating more closely those from Sweden.

The generalization seems warranted that in epidemics affecting a comparatively large proportion of the population in a given area the proportion of adult cases is high. In the very remarkable epidemic of 1910 on the island of Nauru, where 700 cases occurred within a few weeks in a population of little over 2,500, the majority of cases were in adults.[1]

Sex.—More males are affected than females. In Massachusetts in 1909, the ratio was males, 363; females, 263; in Minnesota in 1909, males, 193; females, 139. As shown by Hill[2] in his analysis of the Minnesota cases, the proportion of males and females affected is more nearly equal in the first decade of life, while after 10 years of age males are affected in much greater proportion than females.

Race.—There is little to indicate that nationality has any influence upon susceptibility. In the New York epidemic of 1907, there were proportionately fewer cases among the negroes than among white races. Upon the island of Nauru the population and attack rate are given as follows:

	Number of persons.	Number of cases.	Number of cases per 1,000.
Natives	1,250	470	376
Imported laborers[1]	1,000	220	220
Whites	80	3	37.5

[1] Partly Chinese and partly Caroline Islanders.

The death rate among the natives was 7.8 per cent, while among the imported laborers it was 0.45 per cent, and among the whites (3 cases) there was no mortality. There was, therefore, in this instance, apparently a very marked difference in racial susceptibility; but this epidemic was so remarkable in many other respects that it can not be taken as illustrative of epidemic poliomyelitis in general.

The high death rate and large proportion of adult cases in Norway and Sweden arouse a suspicion that the Scandinavians may be peculiarly susceptible. In this connection it may be noted that in the

[1] Müller, A., Arch. f. Schiffs-u. Trop.-Hyg., 1910, vol. 14, No. 17.

[2] Hill, H. W.: Epidemiologic study of anterior poliomyelitis in Minnesota, Trans. Section on Preventive Med., Amer. Med. Assn., 1910.

United States the most fatal and most infective epidemics have occurred in the Middle West and Northwest, where a large proportion of the population is of Scandinavian descent. On the other hand, it has not been shown that an undue proportion of Scandinavians have been attacked, even in the Northwest. The question of difference in racial susceptibility is therefore still an open one.

Social and hygienic conditions.—Poverty and insanitary conditions of life seem to have little, if any, influence in determining infection. All classes are affected in about equal proportions.

PATHOLOGY.

A widespread misunderstanding of the pathologic anatomy of acute poliomyelitis has contributed largely to a very prevalent misconception of its symptoms. The earlier pathologic studies were made chiefly on cases that had long since passed the acute stage. The most characteristic lesion observed in such cases is degeneration of the motor cells in the anterior cornua of the cord, and this was therefore naturally regarded as the essential *primary* lesion of the disease. Although for the past 20 years there has been ample evidence, both clinical and anatomical, that in the acute stage the characteristic lesion is an ***interstitial inflammation, not confined to the motor area of the cord,*** and although these facts have been published in many reference books, still the conception of the disease as essentially an inflammatory degeneration of the motor cells of the cord, has remained fixed in the minds of many of the medical profession, and statements to this effect remain in a considerable proportion of recent textbooks on the practice of medicine. The result is that those who are without experience in epidemics of the disease are unprepared to recognize as characteristic of it such nervous symptoms as are not referable to damage of the *motor cells* of the cord. In order to understand the symptoms observed, it is necessary to have at least a general knowledge of the anatomic lesions to which the symptoms are due.

Acute anterior poliomyelitis must be recognized as a general infection producing characteristic lesions in the central nervous symptoms, viz, ***congestion, infiltration and edema of the cord, brain, and leptomeninges.***

MENINGES.

The dura mater is practically unchanged. The pia-arachnoid throughout the cerebrospinal axis shows quite constant and characteristic changes in the acute stage. The vessels are congested and their sheaths infiltrated with round cells. Between the vessels the infiltration is more diffuse. The round cells are mostly mononuclear.

No exudate is found on the surface of the meninges, which to the naked eye appear normal or simply congested. The infiltration of the pia mater varies at different levels; it is most intense in the lumbar region, where it is equally marked around the whole circumference of the cord. In the higher segments the infiltration of the pia mater is most marked over the anterior surface of the cord, and may be quite irregular in its distribution.

It is believed that the meninges are the seat of the earliest changes in the central nervous system; that the virus first invades the leptomeninges, and extends thence, following the vascular prolongations of the pia, into the substance of the brain and cord.

CEREBRO-SPINAL FLUID.

Corresponding to the changes in the meninges, there are characteristic changes in the cerebro-spinal fluid. It is increased in quantity quite early, before the onset of definite symptoms. At this time the fluid is opalescent, due to an increase in the number of cells; the protein is increased, and the fluid may coagulate spontaneously. The cellular elements are chiefly lymphocytes, although in the earlier stages there may be a large proportion of polymorphonuclear leucocytes. By the time paralysis has developed the cerebro-spinal fluid has returned more nearly to the normal; it is now clear, but still more or less increased in quantity, and still contains an abnormal number of lymphocytes.

CORD.

The early changes in the cord are congestion, round-cell infiltration, and edema. All *the vessels of the cord* are congested, and their sheaths show an infiltration of round cells similar to and continuous with the perivascular infiltration of the pia mater. In the *gray matter*, more especially in the anterior cornua, at the level of the cervical and dorsal enlargements, in addition to the infiltration immediately around the vessels, there is a more diffuse infiltration, with here and there foci of closely packed round cells. Hemorrhages, due to the rupture of small blood vessels, are quite commonly found in the gray matter and less frequently in the white substance. The infiltration is all of vascular origin, and its distribution in various areas of the cord is proportional to the vascularity of these areas. Because of a richer blood supply, the gray matter is more affected than the white, the anterior cornua more than the posterior, and the cervical and lumbar enlargements more than the other segments of the cord. The irregular distribution of the paralysis probably depends to some extent upon irregularities in the blood supply of the cord.

The ganglion cells of the cord suffer more or less secondary damage, which is generally proportionate to the infiltration around them.

The most common and extensive damage occurs in the motor nerve cells situated in the anterior cornua, especially in the lumbar and cervical enlargements, where, as already noted, the infiltration is most intense; but considerable damage, and even destruction, of some of the ganglion cells in the posterior horn, especially in Clark's column, is not uncommon. In the lumbar cord, according to Wickman, the posterior cornua show quite as extensive lesions as the anterior cornua. The damage to the ganglion cells may result in temporary loss of function, perhaps due to edema, without demonstrable changes in the cell; in partial but not permanent degeneration of the cells, or in the complete destruction of a part or all of the cells in a given area of the cord. Complete destruction of the ganglion cells of the anterior cornua in a segment of the cord results in permanent motor paralysis and atrophy of the muscles *supplied* by these neurons. The less severe cell changes result in paresis or temporary paralysis of the corresponding muscles.

The *white substance* of the cord undergoes less severe changes than the gray matter, but constantly shows infiltration of the vessel walls, edema, occasional small hemorrhages and rarely definite foci of round-cell infiltration. The acute inflammatory lesions of the white substance of the cord are important to bear in mind as explanatory of some of the symptoms in the acute stage. The rarer, more permanent lesions found here may explain some unusual motor disturbances (ataxia, exaggerated reflexes, spasticity) occasionally encountered.

SPINAL GANGLIA.

The intervertebral ganglia have been found to show changes similar to those in the cord, viz., infiltration, and degeneration of ganglion cells and nerve fibers (Straus, Flexner).

PERIPHERAL NERVES.

The peripheral nerves have not been examined as carefully as the spinal cord, but it is believed that they show no acute inflammation, except perhaps near their emergence from the spinal cord.

MEDULLA.

In the medulla oblongata and pons cerebri there are found edema and perivascular infiltration as in the spinal cord; and also, not infrequently, foci of round cells. Infiltration around the nuclei of the cranial nerves explains the cranial-nerve paralysis often noted in acute poliomyelitis. The ganglion cells in the foci of infiltration are more or less damaged; but as the foci are usually small, the complete destruction of a bulbar nerve center is rather rare.

CEREBRUM.

Changes in the brain similar to those in the cord, but less intense, are a constant characteristic of acute poliomyelitis. Severe lesions of the cerebral cortex or the conducting paths therefrom are rare, but may occur.

OTHER ORGANS.

The lesions outside the nervous system are not characteristic and are apparently not constant. In quite a number of autopsies, however, lesions have been found indicative of acute general infection, affecting especially the digestive and respiratory tracts and the lymph glands, viz., congestion of the mucous membrane of the small intestine and sometimes of the stomach; congestion and enlargement of the solitary follicles, Peyer's patches and mesenteric glands; less commonly a more general glandular enlargement; occasional pneumonic foci in the lungs; congestion of the liver and spleen, with occasional enlargement of the latter; congestion and sometimes beginning parenchymatous degeneration of the kidneys.

THE BLOOD.

The characteristic blood changes in the acute stage are diminution of the total number of white cells (leucopenia) with relative increase in the proportion of *lymphocytes*. More observations are needed to fully establish the constancy and degree of these changes.

SYMPTOMATOLOGY.

As is to be expected from its patholgy the symptoms of acute poliomyelitis are most diverse. Broadly speaking, they are the symptoms which may be expected from—

(1) An acute general infection.

(2) An acute inflammation affecting the leptomeninges and medullary substance of the brain and cord. The nervous symptoms are first those of irritation, followed in more severe cases by symptoms of depression, and in typical cases by loss of function of certain areas of the central nervous system. The irritative symptoms, arising from inflammatory lesions of comparatively mild degree but wide extent, are usually both sensory and motor; predominantly spinal, but to some extent bulbar and cerebral. The depression and loss of function resulting from more intense inflammatory changes, characteristically localized in the anterior cornua of the cord, are motor.

Of a disease embracing such a variety of symptoms it is impossible to give a single, clear-cut, clinical picture. Wickman has differentiated eight clinical types, and as later observations have confirmed

his classification, it will be adopted and followed as closely as consistent with the scope and purpose of this paper. Wickman's types of acute poliomyelitis are as follows:

I. The *spinal poliomyelitic* type, characterized by onset with fever. gastro-intestinal disturbances or angina, headache, pain, often rigidity of the neck and spine, and pains in the extremities of varying intensity and distribution. From one to six days after the onset of the febrile symptoms there develops a paralysis which has certain distinctive characteristics, viz, it is a flaccid, motor paralysis. It is sudden in its onset, reaching its height within a few days, after which it shows a regression in extent, the final result being usually a permanent paralysis of considerably less extent than in the acute stage, although complete recovery may take place. This is the most common and easily recognized form of acute anterior poliomyelitis.

II. The *ascending* or *descending* type of paralysis runs the clinical course of a *Landry's paralysis*. Beginning usually in the lower extremities, the paralysis ascends until it involves, in some instances, the whole of the body; such cases usually terminate fatally from respiratory paralysis. In rare cases the paralysis is descending instead of ascending.

III. The *bulbar* or *pontine* form is characterized by paralysis of muscles supplied by cranial nerves (having their nuclei in the medulla or pons).

IV. The *encephalitic* type is distinguished by paralysis due to lesions in the motor area of the brain, resulting in a spastic monoplegia or hemiplegia. This is the rarest type.

V. In the *ataxic* type the characteristic motor disturbance is an acute ataxia, with or without paralysis.

VI. The *polyneuritic* type gives a clinical picture closely resembling multiple neuritis.

VII. The *meningeal* type includes (1) cases which in their onset are characterized by marked symptoms of meningitis, but which result in spinal or bulbar paralysis; and (2) cases in which the symptoms of meningitis are not followed by paralysis.

VIII. Abortive types include cases showing the initial symptoms of acute poliomyelitis, but not followed by paralysis.

The differentiation of these types depends upon the localization of the lesions in the central nervous system. The initial symptoms, before definite localization has taken place, are in a general way similar in all the types.

INCUBATION.

The incubation period of acute poliomyelitis has been found to vary from 3 to 46 days in monkeys experimentally inoculated, the more common period being from 7 to 15 days. The length of incu-

bation in persons has not been definitely determined. Approximately 2 to 10 days has been generally accepted as the most usual period, but apparently great variations occur, the period being sometimes prolonged to 3 weeks or more.

INITIAL SYMPTOMS.

Definite prodromal symptoms are relatively rare. In some cases malaise, weakness, digestive disturbances (nausea, constipation, or diarrhea), angina or restlessness precede by several days the definite onset of the acute febrile stage. Bronchitis and coryza more rarely precede an attack of acute poliomyelitis—probably not more often than may be ascribed to coincidence.

Sometimes the disease develops in two stages. After slight, indefinite prodromal symptoms, the patient apparently recovers completely in a few days, and with no suspicion of a serious illness, returns to the usual routine of life; but a few days later is stricken down by an acute attack of poliomyelitis. Wickman expresses the suspicion that these cases may be relapses, brought on by exertion, and may illustrate the therapeutic value of *rest*, after even a very mild attack of this disease.

Numerous cases are reported in which no constitutional disturbance was noted prior to paralysis. As such cases have most commonly occurred in children, it is probable that in many instances a mild febrile stage has been overlooked. It nevertheless appears to be certain that cases of poliomyelitis may develop with constitutional symptoms which are negligible.

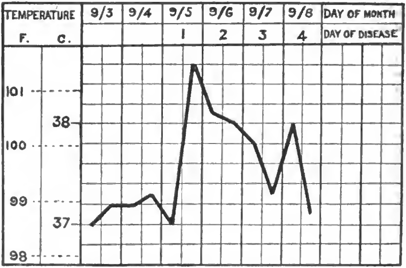
ONSET.

Acute poliomyelitis is usually quite abrupt in its onset, suddenly prostrating persons in apparently good health. The first symptoms observed vary a good deal. A sudden, sharp rise of temperature is probably the most common feature; a definite chill is rare. In its onset acute poliomyelitis may present the clinical picture of mild meningitis, acute neuritis, gastroenteritis, or tonsillitis. In some epidemics gastroenteritis has been the most prominent symptom of onset; in others, meningitis, neuritis, or tonsillitis. In a certain proportion of cases the onset is gradual and insidious.

GENERAL SYMPTOMS.

Fever is perhaps the most constant single symptom, although it seems fairly well established that some cases run their course without fever. The rise of temperature is usually sudden and sharp, often reaching its maximum in the first day of illness.

The range of temperature is quite variable. Wickman states that it is usually from 38° to 39° C. (99° to 102.2° F.). The investigation of the New York epidemic of 1907 showed the most usual range of fever to be from 101° to 104° F. Higher temperatures (105°–106° F.) have occasionally been noted. The height of the temperature is, according to Wickman, no index to the severity of the infection. It has been noted, however, by Lovett and Lucas[1] that cases in which the onset is accompanied by severe symptoms are more apt to result in extensive paralysis than cases with mild symptoms. Abortive cases, which recover in a few days, may, however, run quite as high temperatures as cases resulting in extensive paralysis or death.



C. R. D. Boy, 4 months old. Taken sick in General Foundling Asylum, Stockholm, Sept. 5, 1899. Extensive paralysis. Died Sept. 9, 1899. (Wickman, 1907.)

Exact records of the course of the fever are scarce. The following charts, adopted from Wickman, illustrate the irregularities in the development and course of the fever.

The fever may be expected to continue from one to seven days, usually falling to normal about the time paralysis develops. Cases are cited, however, in which the fever has continued for several weeks.

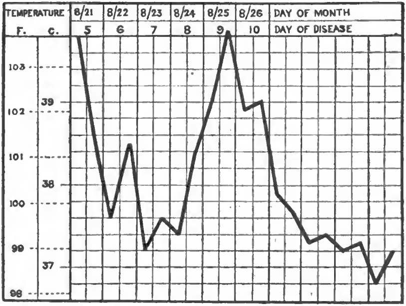
Headache is complained of by a large proportion of those who are old enough to give a clear account of their sensations. According to Wickman's observations the headache is usually occipital, but the committee which investigated the New York epidemic found it

[1] Lovett, R. W., and Lucas, W. P., Jour. Am. Med. Assn., 1908, vol. 51, pp. 1677–1684.

more commonly general or frontal. The headache is usually of moderate severity, such as is to be expected in almost any acute general infection, but is occasionally intense, constituting the most prominent symptom.

Prostration.—When the onset is sudden and acute there is marked prostration from the first. Even in cases with mild constitutional symptoms the prostration is often much greater than would be expected. Extreme weariness and muscular weakness are characteristic features of many mild, abortive cases.

Digestive system.—Some disturbance of digestion is among the most common early symptoms. Constipation is perhaps the most



J. P. Girl, 17 years old. Taken sick Aug. 17, 1905. Quite extensive paralysis of arms and legs. (Wickman, 1907.)

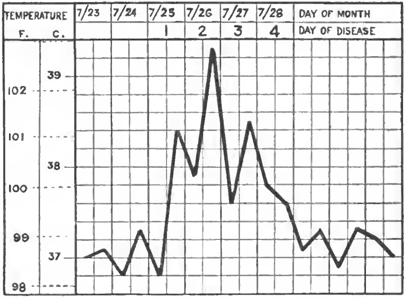
usual derangement. Diarrhea has been very common in certain epidemics, notably one in Westphalia studied by Krause,[1] but in recent American epidemics has been found to be much less usual than constipation. More serious disturbances of the bowels, such as obstipation or incontinence are rather rare. Vomiting is very common; it usually occurs early in the illness and subsides in a few days. When constipation is marked there is apt to be abdominal distention.

Respiratory system.—Catarrhal conditions of the respiratory system are rare, a point emphasized by Wickman as an aid in the early differentiation of acute poliomyelitis from influenza, which it often

[1] Krause, P., Deutsch. med. Wochenschr., 1909, vol. 35, p. 1822.

resembles in many respects. Sore throat is fairly common in some epidemics but is not in general a prominent symptom. More serious respiratory troubles, especially broncho-pneumonia, may develop later in the disease, due to paresis or paralysis of respiratory muscles.

Urinary system.—Although, post-mortem, the kidneys are sometimes found congested, with incipient parenchymatous degeneration, there is very seldom any clinical evidence of damage to the urinary organs. Albuminuria is rare. Retention of the urine occurs occasionally. Incontinence of urine is more rare.



K. J. Boy, 2½ years old. Convalescent from an exudative pleurisy at time of onset (of acute anterior poliomyelitis), July 25, 1899. Paralysis of the neck, July 26. (Wickman, 1907.)

Circulatory system.—The heart's action suffers the derangement common to acute infections. More serious disturbances—arrhythmia, tachycardia, bradycardia—may result from early involvement of the vagus center. Vaso-motor disturbances are sometimes observed, but are not characteristic.

The skin.—Excessive sweating has been noted by Müller[1] as a characteristic early symptom. While this has been noted occasionally in the epidemics studied elsewhere, it has not been found a constant distinctive feature. Skin eruptions were noted in less than 10 per cent of the cases investigated in the New York epidemic of 1907, and in 6 out of 150 cases studied in Massachusetts in 1909. The char-

[1] Müller, Eduard, Münch. med. Wochenschr., 1909, vol. 56, pp. 2460–2462.

acter of the skin lesions varied greatly. No skin eruption can be said to be at all characteristic of acute poliomyelitis. The rarity of herpes has been noted by Wickman.

NERVOUS SYMPTOMS.

Restlessness or irritability is a very common and marked symptom. In children very often the first symptom to attract attention is their irritability. Older persons frequently show an early stage of excitement, characterized by extreme restlessness, vague anxiety, and mental perturbation out of proportion to the severity of their other symptoms.

An *apathetic, drowsy state* frequently follows, especially in children. A child may lie sometimes for a day or more, asleep or half asleep, unless aroused; but when aroused, the faculties are clear, or at most, somewhat confused. *Coma* is rare, it being a noteworthy feature of acute poliomyelitis that even in fatal cases the patient usually retains consciousness throughout the greater part of the illness. *Delirium* is not uncommon, but is usually of short duration, occurs early, and is often a confused state rather than a wild delirium such as characterizes meningitis. *Convulsions* sometimes occur in children.

Pain and tenderness.—Pain of some sort is a very constant early symptom, giving clinical confirmation to the anatomical studies which have shown the involvement of the meninges and spinal ganglia of the cord in the acute stage. The most characteristic pain is in the back of the neck and spine; the whole of the spinal column may be painful, especially on motion, and very tender. It is Wickman's opinion that the pain which young children evidently feel on being moved is due rather to the tenderness and consequent rigidity of the spine than to general cutaneous hyperesthesia. The pain in the neck and back is sometimes extremely severe. Pains are also very common in the arms and legs, sometimes in the face, and less commonly in the trunk. The pains in the limbs may resemble a myalgia, without cutaneous hyperesthesia or tenderness over the nerve trunks. In other cases, however, the clinical picture is that of neuritis, with marked hyperesthesia and tenderness over nerve trunks. The pains may be of short duration, subsiding with or before the onset of paralysis, but in some cases tenderness over the nerve trunks persists for weeks.

Sensory disturbances other than pain have been observed occasionally. *Paræsthesias* are not uncommon; numbness is noted in a fair proportion of cases in older children and adults. Wickman describes a case observed by him, with motor paralysis of both lower limbs, great *diminution of the sense of pain* from the hips down, and

diminution of temperature-sense in the feet. He cites a similar case described by Wernicke, and also cites from reference other cases, in one of which there was complete *anesthesia*, and in several others *loss of electrocutaneous sensation.* Wickman thinks it probable from the pathology of the disease that closer observation of cases would show disturbances of temperature, pain, and electro-cutaneous sensation to be more common than heretofore reported.

Meningitic symptoms.—A train of symptoms indicative of meningeal irritation is frequently observed; these symptoms are—

Pain in the neck, which in varying degrees of intensity is quite common; *stiffness of the neck*, usually of moderate severity, rendering it painful or even impossible to bend the head forward; less frequently *retraction of the head*, due to actual contraction of the posterior neck muscles. While marked retraction of the head, such as is characteristic of cerebro-spinal meningitis is rare, a great many cases are found in which the head is held farther back than normal. *Stiffness of the spine* is usually due to the pain which motion of the spine causes, but in rare cases is due to actual *contracture of the spinal muscles.* A modified *Kernig's sign*—that is, inability to completely extend the leg when the thigh is flexed at a right angle, is sometimes present in cases showing other meningitic symptoms.

Some of the above symptoms are seen in the majority of cases with acute onset, as is to be expected from the fact that the pia mater is always found to be congested and infiltrated in the acute stage. Meningitic symptoms of moderate severity, when present, constitute the most characteristic symptom-complex of the early stage of acute poliomyelitis. When the meningitic symptoms are severe, the differentiation from cerebro-spinal meningitis may be impossible without examination of the cerebro-spinal fluid.

Motor symptoms.—Prior to the onset of paralysis, as well as in cases which do not result in paralysis, disturbance of the motor centers may be indicated by muscular twitching, jerking of the limbs, or tremor. The jerking of the limbs is usually slight and irregular. It may be most noticeable when the patient is asleep or may be brought on by the disturbance incident to making a physical examination. In one case which came under the writer's observation a slight disturbance of the patient set up clonic movements of one leg, continuing for several minutes. The other leg was flaccid, almost completely paralyzed.

Reflexes.—The patellar reflex is quite commonly exaggerated in the early stages, but is almost always diminished or abolished prior to the onset of paralysis; it may be abolished on one side and exaggerated on the other. In rare cases a persistently exaggerated patellar reflex may be associated with bulbar or cervical-segment paralysis (Wickman).

Reflexes other than the patellar have not been studied closely or extensively enough to warrant definite generalizations. Krause[1] found the skin, plantar, abdominal, and cremasteric reflexes normal in most cases. The New York investigating committee states that "A study of the reflexes established the general doctrine that in poliomyelitis the deep reflexes in the parts paralyzed are absent and that they are often absent in nonparalyzed parts."

Disturbances of the ocular reflexes are not characteristic, but need cause no surprise if noted in occasional cases.

Summarizing briefly the symptoms above enumerated, the characteristic features of acute anterior poliomyelitis in the early stage are sudden onset with fever, gastro-enteric disturbances (vomiting, diarrhea, constipation), occasionally sore throat, headache, restlessness followed often by apathy, pains in the neck, back, and limbs: muscular twitchings, exaggeration or abolition of tendon reflexes. Symptoms of a rather mild meningitis are present in a varying proportion of cases, and when present are rather characteristic.

The clinical picture prior to the onset of paralysis may be that of an indefinite general infection or toxemia, gastro-enteritis, tonsillitis, multiple neuritis, meningitis, or encephalitis.

TYPES OF ACUTE POLIOMYELITIS.

I. THE SPINAL POLIOMYELITIC TYPE.

The characteristic of this, the most typical and common form of poliomyelitis, is the development of a *flaccid motor* paralysis of parts supplied by nerves of *spinal* origin.

The paralysis develops, in the great majority of cases, within a week after the onset of acute symptoms, most commonly from the second to the fourth day. In exceptional instances it may develop more than a week after the onset.

In small children it is difficult to follow accurately the development of paralysis, which has given rise to the common statement that complete paralysis develops quite suddenly. Observations upon older persons have shown that the paralysis is often somewhat more gradual in its onset, beginning as a paresis, which may not be noted even by the patient until some effort is made which requires considerable strength. For instance, an adult, able to move his legs in bed, may not suspect a loss of power in them until he attempts to stand. Or the first indication of a beginning paralysis may be intention tremor and incoordination. In some cases the weakness never progresses to actual paralysis, receding sometimes to complete recovery in a few days. Cases of this kind are undoubtedly often overlooked in children. Usually, however, the paresis progresses rapidly to

[1] Münch. med. Wochenschr., 1910, vol. 57, p. 47.

complete paralysis of the affected part, reaching its maximum, both in degree and extent, within one or two days. It is quite the general rule that the extent of the paralysis is greater at first than it is later. The paralysis is primarily due to edema and infiltration of the cord. As the acute inflammation in the cord subsides, improvement takes place in some of the affected limbs. This improvement may be quite rapid, so that a limb which was completely paralyzed may return to normal in a few weeks, or even in a few days. Where the acute process has resulted in the destruction of the ganglion cells there is, of course, no return of function in the corresponding muscle. The parts supplied by nerves from these centers are permanently paralyzed. Between edema and infiltration, with transitory disturbance of the function of the ganglion cells in an area, and complete destruction of the ganglion cells, there are many gradations. The cells may be damaged so severely as to return slowly to normal, or only a part of the cells in an area may be destroyed, leaving the rest capable of performing their function. The rate and degree of improvement is correspondingly variable, and there is no certain means of telling, when the paralysis is at its maximum, how extensive it will finally be.

A sufficient number of statistics have been collected within the past few years to warrant some generalizations as to the parts most commonly paralyzed. The lower limbs are affected more than twice as frequently as the upper. Any combination may occur, as both legs, one leg and one arm of the same or opposite sides, both legs and one arm, both legs and both arms, both arms and one leg, both arms alone, etc. Combinations of parts supplied by the same spinal segment are more common than combinations of parts supplied by different segments—for example, it is more common to have paralysis of both legs than of one leg and one arm.

The resulting permanent paralysis, while it may involve one or more limbs in their entirety, is more usually limited to certain muscle-groups. In the lower limbs the groups most often affected are the peroneal and the quadriceps femoris. In the upper extremity the scapular muscles, deltoid, and upper-arm muscles are more frequently affected than the muscles of the forearm and hand.

Paralysis of the extremities is the most common and most serious feature of poliomyelitis; but the muscles of the trunk are affected more often than is generally supposed. In the acute stage the muscles of the back are very often paralyzed. As this usually occurs while the patient is confined to bed and in connection with paralysis of one or more extremities and is often of comparatively short duration, it may easily be overlooked. Paralysis of the neck muscles, rendering the patient unable to raise the head, is less common, occurs most frequently in combination with paralysis of the upper extremities, and can hardly be overlooked. Wickman lays emphasis upon

the comparative frequency of paralysis of the abdominal muscles, usually associated with rather extensive paralysis of the extremities. When abdominal paralysis is bilateral, distention is apt to result; the abdomen is flaccid and can not be contracted in expiratory efforts; the patient is unable to raise his body from the recumbent posture without support. Unilateral or more localized abdominal paralysis may give rise to hernia-like protrusions and retraction of the navel toward the unaffected side.

Paralysis of the bladder and rectum is very rare as compared with paralysis of the lower limbs. In cases with extensive paralysis of the extremities, retention of urine may occur, indicating a paralysis of the bladder, but this condition is almost without exception of short duration. Paralysis of the sphincters, with incontinence of feces or urine, is also rare.

Paralysis of the muscles of respiration seldom occurs except in cases of extensive paralysis. It may occur, however, with less extensive paralysis of parts supplied by the cervical segment of the cord. If the intercostal muscles are paralyzed, the chest is immobile, and respiration is of the abdominal type. Paralysis of the diaphragm causes a reversal of the usual *abdominal* movements in respiration; the abdomen is retracted in inspiration and protruded in expiration. Diaphragmatic paralysis is more serious than intercostal paralysis. Paralysis of both diaphragm and intercostals causes death by respiratory failure. Respiratory paralysis is the gravest symptom of acute poliomyelitis. Occasionally, however, the disturbance of function of these muscles does not reach total paralysis, and in such cases may be quite transient. If the patient does not die of the respiratory paralysis or of pneumonia secondary thereto, these muscles are likely to return to their normal function.

The tendon reflexes in paralyzed limbs are totally abolished in the great majority of cases. Prior to the onset of paralysis, however, the reflexes, especially the patellar, are quite commonly exaggerated. The exaggeration of any reflex, however, need not cause astonishment. Even after the development of complete *flaccid* paralysis of a limb, exaggeration of the patellar reflex may persist. This, according to Wickman's view, may be accounted for by a lesion in the pyramidal tract of the cord, overcompensating the diminution of the reflex caused by the partial destruction of the ganglion cells of the anterior cornua.

The eye reflexes have been found disturbed in various ways. The pupils may react sluggishly or unevenly. Wickman has noted in rare cases signs of involvement of the cilio-spinal center in the cervical cord, viz, narrowing of the aperture between the lids of one side, with contraction of the pupil.

The subsidence of the symptoms which characterize the preparalytic stage is usually about coincident with the development of paralysis. The temperature may, however, in rather exceptional cases persist for a week or more after this time. The persistence of other constitutional symptoms is variable. While the acute pains in the limbs usually subside about this time or even before, there is often a persistent tenderness of the muscles and nerve trunks, and considerable pain in the joints on attempted passive motion.

Stage of regression.—As already stated, following the development of paralysis, there is a more or less indefinite stage of improvement. Up to a certain point this improvement is rapid, being noticeable from week to week, perhaps from day to day, until a part or in some cases all the paralyzed muscles are restored to their normal function. After the first few weeks improvement is much slower; the parts which remain paralyzed now show atrophy, and quite frequently a lowering of surface temperature. This indicates a severe degree of damage to the spinal motor centers, but not necessarily complete destruction. Even after several months, improvement may continue to take place in muscles that appeared completely paralyzed.

Contractures of the muscles and deformities of the limbs due to such contractures or to overaction of healthy muscles opposing paralyzed muscles are likely to occur in this stage unless care is exercised in their prevention.

The electrical reactions of the paralyzed limbs usually show alteration by the second week. The alteration may consist of a diminution of the normal electrical excitability of the muscles or more profound changes—the reaction of degeneration. The development of the reaction of degeneration, denoting destruction of the spinal center of a muscle, is given by Church and Petersen [1] as follows:

"First. The *muscle* responds weakly, sluggishly, and deliberately to faradism, and shows a tendency to maintain the contraction after the current is withdrawn. This is the *modal change.*

Second. The *nerve trunk* loses progressively and equally its responsiveness to both galvanism and faradism—a quantitative change.

Third. The *muscle* becomes much more excitable by galvanism and much less excitable by faradism, which latter reaction, with the nerve trunk responses, is completely lost after two or three weeks. This is the *qualitative change.*

Fourth. A *polar change* appears in the *muscle* about the second week, when directly stimulated by galvanism. The anodic closing contraction now equals or exceeds the cathodal closing contraction.

If there has been complete destruction of the nerve elements, with complete degeneration, *all electrical response* is gradually lost."

[1] Church, H., and Petersen, F.: Nervous and Mental Diseases. Phila., 1907, W. B. Saunders Co., 5th ed., p. 46.

II. THE ASCENDING OR DESCENDING TYPE OF PARALYSIS.

In the more common spinal type of poliomyelitis the paralysis is pretty definitely limited, reaching its maximum in a few hours or a few days. In some cases, however, the paralysis progresses from the part first affected, either ascending or descending until nearly the whole of the body is paralyzed, or until death ensues from paralysis of the respiratory muscles. Usually the progress of the paralysis is *upward*, affecting in order the legs, abdomen, back, intercostals, arms, neck, and diaphragm. The progress may be very rapid; in one case which came under my observation, death ensued from respiratory paralysis 48 hours after the onset of the illness and less than 24 hours after paralysis was first noted. In some epidemics cases of this type have been observed more frequently in young adults and older children than in infants. The clinical course of a case of ascending or descending acute poliomyelitis is identical with that of a Landry's paralysis. Wickman has shown that a number of cases diagnosed as Landry's paralysis were in reality acute ascending poliomyelitis. He also doubts whether this type is more common in adults than in children, ascribing the general impression to that effect to the greater accuracy with which the course of the paralysis can be followed in an adult.

When the paralysis is of the descending type, appearing first in the upper extremities or in the muscles supplied by the cranial nerves, death from respiratory failure is likely to occur before the lower limbs are affected.

Respiratory failure may be due either to paralysis of the respiratory muscles (intercostals and diaphragm), as already described, or to a lesion affecting the respiratory center in the medulla. In the latter case the onset of dyspnœa is more sudden. Cheyne-Stokes respiration and acceleration of the heart's action may be noted in such cases, due to interference with the vagus center.

It is typical of such cases as the above that the patient retains consciousness to the end.

III. BULBAR (MEDULLARY) OR PONTINE TYPE.

This type embraces those cases in which there is paralysis of muscles supplied by *cranial* nerves whose nuclei are situated in the medulla oblongata or pons cerebri. It includes: (*a*) cases in which, in addition to the paralysis of the cranial nerves, there is paralysis of typical spinal type, and (*b*) cases in which the only paralysis is bulbar.

Wickman cites Medin (1890) as the first to call attention to the frequency of paralysis of cranial nerves in epidemic poliomyelitis. The unexpected frequency of this form of paralysis has been one of

the striking facts brought out by the recent studies of Wickman, the New York Investigation Committee, the Massachusetts State Board of Health, and others. In the report of the New York committee paralysis of the cranial nerves was found as follows: Facial, 27; eye muscles, 26; eyelids, 18; speech, 28; out of a total of 625 to 700 cases. The report of the Massachusetts State Board of Health for 1909 records 34 cases of facial paralysis in a total of 628 cases of poliomyelitis (4.7 per cent). In 150 cases studied more carefully double vision was noted in four cases, difficulty of deglutition in two, difficulty of speech in two. Medin[1] noted involvement of some of the bulbar centers in 17 out of 65 cases(=26 per cent). It would appear from the wide variations between these statistics that there must be differences in epidemics in regard to the frequency of the occurrence of cranial-nerve paralysis.

The most common paralysis of this type is facial, which is much more often unilateral than bilateral. Ocular paralyses are next in frequency. The external rectus is most frequently affected, causing the eye to turn inward. Paralysis of the oculo-motor may cause divergent squint, with or without ptosis; or, more rarely, ptosis may be the only indication of ocular paralysis. In very rare cases there is paralysis of all the muscles of the eye. Transient motor disturbances of the eye, either nystagmus, diplopia, or fixedness of the eyes may occur. Wickman cites two cases in which the optic nerve was affected, with resulting atrophy and blindness of one eye.

Sudden deafness, usually of short duration, has been noted in the course of acute poliomyelitis, but it is a very rare symptom.

Disturbances of deglutition, when they occur, are usually associated with rather extensive paralysis, although there are exceptions to this. Disturbances of speech were noted in 28 cases (not noted in 615 cases) collected by the New York investigation committee.

Paralysis affecting the respiratory center may also be included as a "bulbar" symptom. In a case reported by the writer sudden death was due apparently to this cause. The patient, a previously healthy girl of 12, after a few days of slight illness, died very suddenly, with no paralysis. There having been no distinctive symptoms of poliomyelitis in this case, the diagnosis was made only by post-mortem histological examination.

Paralysis of bulbar origin is often temporary, as is to be expected from the fact, already cited, that the damage to the ganglion cells in the bulb is usually less severe than in the cord.

Lesions in the white matter which forms the conducting tracts from the cerebellum may perhaps give rise to the acute ataxia noted in some cases. Similar lesions in the pyramidal tracts of the medulla,

[1] Cited by Wickman: Beiträge zur Kenntnis der Heine-Medin'schen Krankheit, p. 27.

interrupting the connection between the cerebral and spinal motor centers, may give rise to exaggeration of reflexes.

IV. CEREBRAL OR ENCEPHALITIC TYPE.

There has long been a discussion among clinicians as to the occurrence, in acute anterior poliomyelitis, of paralysis due to lesions in the motor area of the brain. Paralysis due to such a lesion would be monoplegic or hemiplegic, and spastic, resulting in contractions, but no atrophy. A similar paralysis might result from lesions in the conducting tracts of the upper motor segment.

Paralysis of this type is extremely rare in acute poliomyelitis. Wickman found no example of it among the 1,031 cases studied by him, and the collective investigation of the New York epidemic failed to reveal any case of this type. Wickman, however, considers the occurrence of the type established by the following evidence:

1. Lesions are commonly found in the cortex of the brain at autopsy, even when there has been no clinical evidence of the existence of such lesions.

2. A number of authors [1] have noted, in epidemics of acute poliomyelitis, the occurrence of cases presenting initial symptoms similar to acute poliomyelitis, but resulting in spastic hemiplegia. Pasteur, Buccelli, and Hoffman noted instances in which two or more children of a family were affected about the same time, with similar initial symptoms. One child developed spastic hemiplegia, and the others developed the typical spinal flaccid paralysis of acute poliomyelitis.

3. Others have reported the coexistence in the same patient of typical flaccid spinal poliomyelitic paralysis in one part of the body, and equally typical spastic cerebral paralysis in other parts. Pierre-Marie and Rossi [2] were able to demonstrate by autopsy on a case of this kind well-marked cortical and spinal lesions.

V. THE ATAXIC TYPE.

This type, like the preceding, was first differentiated by Medin, who noted, during the Stockholm epidemic, cases whose motor disturbance was an ataxia of cerebellar type, associated with exaggerated reflexes, not followed by atrophy, and terminating usually in recovery. According to the observations of Wickman and to more recent observations in the United States, cases in which a marked ataxia is the only motor disturbance are relatively rare. It is not rare, however, to find some degree of incoordination associated with

[1] Moebius, Schmidt's Jahrb., 1884; Pasteur, W. Trans. Clin. Soc., 1897; Buccelli, Policlinico, 1897; Strümpell, Beitr. z. path. Anat. u. klin. Med., Leipzig, 1897; Medin, cited by Wickman, Beiträge zur Kenntniss der Heine-Medinschen Krankheit, p. 72; Hoffman, cited by Wickman, ibid.

[2] Cited by Wickman. Beiträge zur Kenntniss der Heine-Medischen Krankheit, pp. 74–75.

paresis in the early stage of cases of acute poliomyelitis. Incoordination may be ascribed to several possible causes:

(1) Lesions of the cerebellum.

(2) Lesions in the conducting tracts leading from the cerebellum.

(3) Lesions in the posterior cornua of the cord, affecting muscle sense.

(4) Paresis of limbs, especially paresis of certain groups of muscles, disturbing the balance between these and their opposing (unaffected) muscles.

(5) Peripheral neuritis.

There is ground to believe that any of the above lesions may occur, in varying degrees, in cases of poliomyelitis, except, perhaps, peripheral neuritis, which is considered improbable.

VI. POLYNEURITIC TYPE.

Wickman describes three classes of cases *clinically* resembling multiple neuritis:

(1) Cases which in the stage of onset are characterized by marked pain and tenderness in the extremities, but which recover without paralysis or with only a transitory paresis; many of these cases could perhaps be better classed as abortive.

(2) Cases in which, after the subsidence of acute symptoms, there remains tenderness of the nerve trunks.

(3) Cases of acute ataxia associated with marked pain and tenderness; such cases may be considered as belonging to either the ataxic or the polyneuritic type, dependent upon the predominance of ataxia, or of pain and tenderness.

The frequent occurrence during epidemics of cases clinically resembling acute polyneuritis, and the occurrence of symptoms of neuritis in cases of undoubted poliomyelitis, are sufficient to establish the identity of causation between this type and the paralytic form of the disease. There has been some discussion as to whether the clinical picture in these cases is actually due to inflammation of the peripheral nerves or to lesions in the cord. Wickman concludes that the lesions are central, giving the following reasons:

(1) There is no loss of sensation in these cases, whereas in toxic, peripheral neuritis, loss of senation is usually more marked than loss of motion.

(2) Post-mortem examination has failed to reveal peripheral neuritis in cases of poliomyelitis, even where the involvement of the cord was very extensive.

(3) These symptoms may all be accounted for by lesions which are quite generally found in the spinal cord in cases of poliomyelitis,

viz, diffuse infiltration and edema of the whole cord, infiltration and edema of the pia mater.

Infiltration of the spinal ganglia has, however, been found at autopsy in cases of poliomyelitis, both human [1] and experimental.[2]

VII. THE MENINGITIC TYPE.

Symptoms indicative of a mild grade of meningitis have been noted (p. 28) as among the most characteristic manifestations of acute anterior poliomyelitis in the early stage. Such symptoms are not usually, however, predominant over the other symptoms. In some cases, the proportion of which seems to vary in different epidemics, the most striking symptom complex of the acute stage is as follows: Intense headache, ocular disturbances, pain in the neck and back, retraction of the head, contracture of the spinal muscles, spasticity of the limbs, Kernig's sign. No better idea can be given of this type than by citing a case of Wickman's:

Wickman's case No. 299.—Boy, 10 years old; taken sick August 18, 1905, after feeling badly for several days. Headache, fever, and vomiting; could be up and out of bed for the first few days, after which he was confined to bed; paresis noted later; stiffness of neck, pains in his whole spine; could not support himself upon his legs.

August 29: Lies with head retracted and stiff neck; cries when attempt is made to raise his head from pillow; can move head from side to side, but can not raise it; is tender all over spine and can hardly bear to be lifted up; the back is bowed (opisthonos) so that the patient can not lie flat upon the mattress; lying upon his back, he is supported upon his shoulders and hips, and a hand may be passed between his back and the bed; patient keeps his knees flexed—can extend them, but only with considerable pain; the feet hang limp and can neither be flexed nor extended; belly retracted and walls tense and tender; abdominal muscles paretic; patellar reflex abolished; cremaster and abdominal reflexes marked.

After about seven weeks in bed he was able to crawl upon the floor and eventually to walk.

October 22, 1905 (examination by Wickman): Gait "wabbly," paretic; patient drags the toes; is said to fall often; leg muscles atrophic and flaccid; thigh muscles feel flaccid, but not noticeably atrophied; diminished dorsal flexion of left foot; otherwise movements of legs all possible but weak; glutei of both sides weak, but can be contracted; has difficulty in raising himself after bending over, as to pick up something from the floor, helping himself up with his hands upon his legs like a person with progressive muscular atrophy. On raising the leg, extended on the thigh, patient feels pain at an angle of about 45°; no pain if knee is flexed; no contractions of muscles; patellar reflex on both sides exaggerated; no ankle clonus.

The diagnosis of poliomyelitis in this case is confirmed by the subsequent development of flaccid paralysis.

[1] Strauss: Epidemic Poliomyelitis, Report of the Collective Investigation Committee on the New York Epidemic of 1907, p. 87.

[2] Flexner, Jour. A. M. A., 1910, vol. 55, pp. 1105–1113.

In other cases, however, there may be no paralysis, or what may be even more confusing, an ocular or facial paralysis. A fatal case of this kind, reported by Wickman, is abstracted for illustration:

H. K., female, age 27, married; taken sick suddenly August 19, 1905, with fever, headache, pains in back; next day vomiting so violently as to dislocate the jaw; tenderness and stiffness of neck, increasing until head was moderately retracted; violent tonic contraction of the shoulder muscles, throwing the arms up to the head; tonic contractions, flexing elbows, flexing fingers, and adducting thumb; cramp in muscles of the lower jaw, drawing it downward; no ocular paralysis; cramps so painful as to require chloroform; evening temperature 37° C. (99.6° F.). Patient fully conscious; during night cramps continued, and later affected muscles of back, causing opisthotonus.

August 21: Morning temperature 38.8° C. (101.8° F.); patient being six months pregnant, eclampsia was suspected, and forced delivery undertaken successfully; cramps continued, extending to legs; inability to swallow and difficulty of speech developed later in the same day; condition continued until death, at 6 a. m., August 22. Patient conscious throughout.

An autopsy was performed, revealing typical histologic lesions of acute poliomyelitis. The cerebrospinal fluid was found greatly increased in quantity and quite clear.

It will be noted that in neither of the above cases was there loss of consciousness. This can not, however, be taken as a constant point of differentiation between the meningitic form of acute poliomyelitis and cerebrospinal meningitis, for cases of poliomyelitis are cited, both by Wickman and by others, in which there was delirium followed by coma.

While there should be no great difficulty in distinguishing between an epidemic of poliomyelitis and an epidemic of cerebrospinal meningitis, there may be great difficulty in making the diagnosis in a particular case, especially if not closely associated with an epidemic of either disease. Lumbar puncture, with examination of the cerebrospinal fluid, is the only certain means of differentiation in such cases.

VIII. ABORTIVE FORMS.

Wickman [1] cites Breiglieb, Pasteur, and Leegard as having noted in intimate association with cases of undoubted poliomyelitis other cases of illness with strikingly similar initial symptoms, but terminating in rapid and complete recovery without paralysis. Caverly [2] also noted during an epidemic of poliomyelitis around Rutland, Vt., in 1894, that the prevalent diseases of children were accompanied by unusual nervous manifestations. It was Wickman, however, who first clearly pointed out the frequent association between cases of undoubted poliomyelitis and cases of a similar illness not followed by paralysis. It was he who recognized the latter as mild or abor-

[1] Wickman: Beiträge zur Kenntniss der Heine-Medinischen Krankheit, p. 132.
[2] Caverly, S. C., Med. Record, 1894, vol. 46, p. 673.

tive forms of acute anterior poliomyelitis, and called attention to the importance of including them in studies of the epidemiology.

In regard to the cases of illness without paralysis, considered by Wickman and others to be abortive forms of poliomyelitis, there are two chief points to be considered; first, whether such cases are due to the same infection as the paralytic forms of poliomyelitis, and second, whether they are clinically distinguishable from other infections.

(*a*) *Etiologic identity of abortive and paralytic forms.*—It has already been noted that the symptoms of acute poliomyelitis are due to *general infection, diffuse inflammation* of the central nervous system, and more severe *localized lesions* of the cord and brain. The localization of the nervous lesions gives to this disease its characteristic features and distinguishes the various types from one another. An abortive case of poliomyelitis may be considered as a case presenting only the symptoms of general infection and perhaps some diffuse inflammation of the cerebrospinal axis. The symptoms referable to these causes would be the same as the early symptoms in cases which later develop characteristic paralysis. There has been no pathologic evidence brought forward to prove the anatomic changes assumed as occurring in abortive cases, but the clinical evidence is very strong:

(1) Many observers in many parts of the world have noted during epidemics of poliomyelitis *cases presenting the same initial symptoms as paralytic cases*, but recovering in a short while without paralysis.

(2) Almost every closely studied epidemic shows a *gradation in severity of nervous symptoms*—extensive permanent paralysis; slight transient paralysis; partial paralysis (paresis); ataxia without paralysis; meningitic or neuritic symptoms without motor disturbances; general infection without distinctive nervous symptoms of any kind. A group of cases showing all these gradations, occurring in a circumscribed area within a short time, all presenting somewhat similar initial symptoms, differing to some extent from the symptoms of more usual infections, seldom fails to convince the observer of the existence of abortive cases of poliomyelitis.

(3) The occasional occurrence of such cases during an epidemic of poliomyelitis might be put down to merely coincident prevalence of two or more distinct infections; the *frequent, almost constant, occurrence* of such cases in intimate association with frank cases of poliomyelitis can not be ascribed to fortuitous coincidence.

(4) Experiments have demonstrated that monkeys inoculated with poliomyelitis occasionally develop an abortive form of the infection, characterized by rather mild and indefinite symptoms. Roemer and Joseph [1] have demonstrated in monkeys an immunity following such abortive attacks.

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[1] Roemer, P., and Joseph, K., Münch. med. Wochenschr., 1910, vol. 57, pp. 520–522.

(5) Netter and Levaditi [2] have shown that the serum of a child recently recovered from an abortive attack was capable of neutralizing the virus of poliomyelitis. This property had been previously demonstrated in the serum of persons and monkeys who had recovered from frank attacks of poliomyelitis and had been shown to be absent from the serum of normal persons and monkeys. It may be taken as convincing evidence of infection with the virus of poliomyelitis.

It is therefore well established by clinical and experimental evidence that the infection of acute anterior poliomyelitis may cause slight illness without definite motor disturbances.

(*b*) *The recognition of abortive cases.*—Granting the occurrence of abortive cases, their recognition remains a difficult problem. In the obsence of any specific diagnostic test it is necessary to recognize, by clinical observations alone, cases which do not present clear-cut clinical characteristics.

The symptoms vary greatly in kind and degree. There is usually some fever, often of very short duration, sometimes less than a day. Headache is one of the most constant features. Many cases exhibit an unusual degree of physical weakness and indisposition to exertion. Nausea and vomiting, associated with either diarrhea or constipation, are the most prominent symptoms in some cases. Restlessness and mental anxiety may be marked in older persons; irritability or drowsiness in children. Pain of some kind is a very common symptom. It may be a neuritic pain of the extremities, with hyperæsthesia, or it may be a myalgic pain of the neck and back. The most characteristic, though perhaps not the most common, pain is in the back of the neck, sometimes extending down the spine. Tenderness over the spine is, in some groups of cases, a common and characteristic symptom. Slight motor disturbances, such as slight paresis, ataxia, or diplopia, may be noted. If definite disturbance of motion can be made out, the case should be classed as frank rather than abortive poliomyelitis; but in children the only manifestation may be a rather indefinite clumsiness or indisposition to use the legs. Disturbance of the patellar reflex, either exaggeration, diminution, or abolition, is often noted. Convulsions or muscular twitchings may be observed in children.

Wickman distinguishes four clinical types of abortive cases:

(1) With symptoms of general infection.

(2) With gastroenteritis.

(3) With pain and hyperesthesia (like neuritic influenza).

(4) With meningitic symptoms (severe occipital headache, pain and tenderness in neck and back, and rigidity of neck).

[2] Netter and Levaditi, Compt. Rend. Soc. Biol., 1910, Vol. LXVIII, No. 18, pp. 855–857.

Cases of the same type quite commonly occur in groups. In one epidemic most of the abortive cases may be of the gastroenteric type, in another of the meningitic type. The meningitic and neuritic types are apparently the more common forms. This may, however, be due to the fact that these forms are more *distinctive*, having less resemblance to the common epidemic diseases of summer, and are therefore more often recognized. There is, of course, no sharp line of differentiation between these several types of cases, which have been classified only according to the most prominent symptoms.

Frequency of abortive cases.—Wickman found among 1,025 cases of poliomyelitis studied in Sweden in 1905, 868 frank cases with paralysis, and 157 (= 15 per cent) abortive cases. He is of the opinion, however, that the proportion of abortive cases is greater than this. In Trästena, a small community where abortive as well as frank cases could be traced, he found 23 abortive cases (= 46 per cent) among a total of 49; in Atvidaberg, 11 abortive cases out of 31 (= 35 per cent), and in Smedjeback, 28 out of 50 (= 56 per cent).

Müller,[1] reporting an epidemic of 700 cases in the island of Naurn in January, 1910, states that many cases recovered without paralysis, and that many others had only slight paresis of two weeks or less duration. Only 50 cases had paralysis remaining after three months.

Anderson [2] observed in Polk County, Nebr., in the summer of 1909, 86 cases, of which 39 (= 44 per cent) had no definite paralysis.

The intensive study of 150 cases by the Massachusetts State Board of Health revealed 49 cases of illness, possibly abortive cases of poliomyelitis, occurring in the same houses with the 150 frank cases.

Mention has already been made of an epidemic which occurred in May, 1910, in a rural school district in Hancock County, Iowa, investigated later by the writer. Within a period of three weeks 30 cases of illness of the same general type occurred among 8 of the 12 families in attendance at this school. Five cases, resulting in typical, definite paralysis, were undoubtedly frank poliomyelitis. The remaining 25 may be considered in all probability abortive attacks of the same infection. The most common symptoms in this group were severe headache, pains in the limbs and back, stiffness of neck and spine, and gastrointestinal disturbances (nausea and constipation).

The proportion of abortive cases reported in various epidemics varies greatly, as is to be expected from the different circumstances under which the epidemics have been studied. In practically every epidemic studied in the light of Wickman's observations some abortive cases have been noted, and it may be stated pretty generally that the closer the observation the greater has been the proportion of abortive cases. From a review of the literature and from personal

[1] Müller, A., Arch. f. Schiffs u. Tropen. Hyg., 1910, vol. 14, No. 17.
[2] Anderson, C. A., Pediatrics, 1910, vol. 22, pp. 543–558.

observations in several localities where poliomyelitis was epidemic I am of the opinion that abortive cases are probably as numerous, and very possibly more numerous, than frank cases.

DIAGNOSIS.

Except in rare cases the diagnosis offers no difficulties after the onset of paralysis. The sudden onset of flaccid paralysis of one or more extremities, without loss of sensation, during or immediately following an acute febrile disturbance, is sufficiently characteristic. The rapid regression of paralysis of some of the parts, the reaction of degeneration, and atrophy of those muscles which remain paralyzed, complete the diagnosis. Even when the paralysis is transitory the diagnosis should offer no great difficulty if a satisfactory history can be obtained. Those cases in which cranial-nerve paralysis occurs without spinal paralysis have doubtless been frequently overlooked or wrongly diagnosed, and require more care in excluding local causes. The diagnosis in cases where the paralysis is of the cerebral, hemiplegic type will be very doubtful unless the early symptoms are quite typical and examinations of cerebro-spinal fluid and blood are made, or unless the association with undoubted cases of poliomyelitis has been striking. The combination of a flaccid paralysis with spastic, hemiplegic, paralysis would make the diagnosis of the cerebral type quite probable. While it is the general rule that the tendon reflexes are diminished or abolished in paralyzed extremities, the finding of persistent exaggerated reflexes does not exclude the diagnosis of poliomyelitis.

It is important to make the diagnosis, wherever possible, before the onset of paralysis, as well as in cases where no paralysis develops. This is obviously of great importance for the success of prophylactic measures. There is no evidence at present that failure to make an early correct diagnosis prejudices the patient's chance of recovery, but in the event that any effective specific treatment should be developed it will be necessary to employ it early. Before the use of a specific remedy it would be advisable to confirm the diagnosis by examinations of cerebrospinal fluid and blood, but the physician must at least suspect poliomyelitis from clinical evidence.

An acute febrile illness, with sudden onset, probably gastrointestinal disturbances, and symptoms of a mild meningitic inflammation, or other nervous symptoms, such as hyperesthesia, pains in the limbs, exaggerated or abolished tendon reflexes, ataxia, tremor, etc., warrants the suspicion of poliomyelitis. The diagnosis in such cases may be reasonably certain if the disease is known to be prevalent in the community. In the vicinity of Mason City, Iowa, the local physicians found it possible to make a fairly definite diagnosis prior to the development of paralysis in a considerable proportion of cases, prob-

ably 50 per cent. In other localities the proportion of cases showing distinctive initial symptoms may be smaller. There is always a certain proportion of cases in which the symptoms prior to paralysis are so slight or so indefinite as to arouse no suspicion of poliomyelitis, even in the presence of an epidemic.

The diseases with which poliomyelitis is most likely to be confounded are influenza, multiple neuritis, muscular rheumatism, acute articular rheumatism, gastroenteritis, and cerebrospinal meningitis. Certain forms of influenza may cause any or all of the symptoms seen in the early stage of poliomyelitis. Important considerations in the differential diagnosis are the frequency of catarrhal conditions of the respiratory tract in influenza and their rarity in poliomyelitis; the common occurrence of ear troubles in influenza; the greater prevalence of influenza in the winter months and of poliomyelitis in the summer months.

As already stated, the polyneuritic type of poliomyelitis gives at first a clinical picture identical with that of acute neuritis, from which it can be distinguished only by the subsequent developments. The swelling of the joints in acute articular rheumatism and the usual absence of severe constitutional symptoms in myalgia readily differentiate these diseases. Occasionally there is in acute anterior poliomyelitis tenderness and swelling of the joints, making the differentiation from acute articular rheumatism exceedingly difficult. Cerebrospinal meningitis can, in the great majority of cases, be excluded without lumbar puncture. Quantitative and differential leucocyte counts may be of aid, for in cerebrospinal meningitis the leucocyte count is high and the polymorphoneuclear leucocytes relatively increased, while in poliomyelitis there is more apt to be a leucopenia with relative increase in lymphocytes. In cases of the severe meningitic type, however, lumbar puncture is the only certain means of diagnosis.

TREATMENT.

No specific treatment has been developed.

The treatment in the acute stage must therefore be symptomatic, directed along the same general lines as in other acute infectious diseases.

Rest is important, and even in very mild cases should be enforced for a while after the subsidence of acute symptoms.

Moderate purgation is recommended, and, if necessary, enemata. Diuresis should be promoted by the free administration of water, or by saline enemata, in cases requiring them. Hot packs are useful to promote diaphoresis and to relieve the restlessness and the pains.

The diet during the acute stage should be liquid, easily digestible, and nutritious.

The administration of urotropin (hexamethylene-tetramine) is advised on the ground that formalin is excreted into the cerebrospinal fluid. While there is no proof as yet that this drug has any effect in modifying the course of the disease, its use is free from any valid objection and is quite generally recommended.

Except when absolutely necessary to allay severe pain, drugs which have for their purpose the relief of nervous symptoms should be avoided, especially the antipyretics and analgesics. Morphine or codeine may be given when necessary to allay pain.

When symptoms of pressure are present a lumbar puncture may be made, with the hope of relieving the condition. This should be done, however, with the strictest aseptic precautions, should not be undertaken by the inexperienced, and is not advised as an indiscriminate therapeutic measure.

The effect of any treatment in the acute stage is extremely difficult to ascertain. Quite independently of any treatment, cases which have severe early symptoms may recover in a few days with no paralysis at all, while other cases, with less severe initial symptoms, may result in extensive paralysis or death. The proportion of abortive and paralytic cases also varies greatly. In some epidemics half of the cases have been of the abortive type. It is therefore evident that even the complete recovery of a large proportion of apparently severe cases does not indicate that there was any specific virtue in the treatment which they received.

It is, however, reasonable to suppose that intelligent treatment along the lines indicated above will aid the patient in combating the infection, and will have some effect, however slight, in modifying the course of the disease.

The objects of treatment after the subsidence of the acute stage are to promote the comfort and general nutrition of the patient, prevent contractures and deformities of paralyzed parts, and to maintain the nutrition of paralyzed muscles. The general health of the patient is usually good, and intelligent supervision of diet, ventilation, etc., is all that is necessary to maintain it. Tonics may be given, but the administration of strychnine in doses larger than are usually given in tonics, with the idea of its exerting a specific restorative action upon the spinal motor centers is to be avoided.

For a considerable time after the onset of paralysis there is often pain in the paralyzed parts, due to sensitiveness of the nerve trunks. Motion may be very painful, and the limbs often become quite rigidly flexed. Hot baths, with gentle exercise, will do much toward relieving this pain and preventing or lessening contractures. Massage and electricity are contraindicated while pain and tenderness persist. Deformities must be prevented by suitable mechanical appliances, designed to keep the limbs in proper anatomic position.

For the treatment of the residual paralysis, after the subsidence of all acute symptoms, the reader is referred to articles cited in the appended bibliography and to the standard textbooks on orthopedic surgery.

PROPHYLAXIS.

While there are differences of opinion as to the contagiousness of epidemic poliomyelitis, its probability has been sufficiently demonstrated to render preventive measures imperative.

The patient should be isolated as completely as possible in a clean, bare room, well screened to keep out insects. The members of the family, other than the necessary attendant, should not be allowed to come into contact with the patient. All discharges, including sputum, nasal secretions, urine, and feces, as well as all articles (linen, eating and drinking utensils, etc.) which may be soiled by such discharges, should be thoroughly disinfected before they leave the sick room. The nurse and physician should observe the same precautions regarding their hands and clothing as in attending a case of scarlet fever.

The rest of the family should, so far as possible, be kept out of contact with the neighbors, at least to the extent of excluding the rest of the family from school and prohibiting all unnecessary visiting. The period during which isolation should be maintained is as yet indeterminate. Three weeks would seem to be a reasonable minimum for exclusion from school; but in some cases it may prove more practicable to fumigate the premises earlier than this.

Since the virus can be killed experimentally by a 1 per cent solution of peroxide of hydrogen, an antiseptic gargle of this solution is recommended to be used by the patient and other members of the family. The mentholated powder above mentioned (page 12) might perhaps be substituted for or used in conjunction with this solution.

As soon as practicable after the recovery of the patient the house should be fumigated with formaldehyd. If vermin are present, it would be advisable to use sulphur instead of formaldehyd.

In the presence of an epidemic it would be advisable to keep down the dust by sprinkling streets and yards. This is recommended because dry-weather conditions have seemed generally more favorable to the spread of epidemic poliomyelitis and because in several instances the abatement of dust has been followed by the cessation of an epidemic. It would also be advisable during an epidemic to keep children off the streets and away from public gatherings, to prohibit their using public drinking cups, to pay careful attention to their diet, to prevent gastrointestinal disorders, and to protect them from overheating and overexertion. which might lower vital resistance.

It is beyond the scope of this paper to enter into a discussion of State and municipal preventive measures. There is, however, practically unanimous agreement on the following points:

(1) That the disease should be required to be reported to the health authorities.

(2) That patients should be isolated.

(3) That members of their family should be excluded from schools for at least three weeks.

The degree of effectiveness of prophylactic measures is very problematic. A very apparent obstacle is the difficulty of recognizing cases early before the onset of paralysis and the difficulty, perhaps impossibility, of recognizing abortive forms.

PROGNOSIS.

The mortality from epidemic poliomyelitis varies greatly in different epidemics, as shown by the following figures, collected from several sources. Only cases showing *paralysis* are included in these figures.

Reported by—	Place.	Year.	Total cases.	Deaths.	Percentage mortality.
Caverly	Connecticut	1894	126	18	14
Wickman	Sweden (general)	1905	868	145	16.7
Do	Trastena, Sweden	1905	26	11	42.3
Do	Atudaberg, Sweden	1905	41	4	10
Do	Smedjeback, Sweden	1906	22	5	22.7
Committee of Investigation	New York	1907	[1] 2,000	[1] 100	[1] 5
Hill	Minnesota	1909	283	68	24
Lovett	Massachusetts	1909	628	51	8

[1] Estimated.

The mortality also shows variations according to the age of the persons affected; Wickman gives the mortality at different ages in 842 cases as follows: 0–11 years, 592 cases, 71 deaths, =12.2 per cent; 12–32 years, 250 cases, 69 deaths, =27.9 per cent.

The Massachusetts State Board of Health found the mortality in 628 cases, in 1909, to be as follows: Less than 1 year, 16 per cent; 1–10 years, 4 per cent; over 10 years, 20 per cent.

These figures agree in showing that the disease is relatively more fatal in older persons than in young children.

According to Wickman's statistics, death occurs most frequently within the first week of illness. Paralysis of respiration is the most frequent cause of death. Broncho-pneumonia, secondary to partial respiratory paralysis, may result fatally. The severity of the early symptoms bears no constant relation to the extent of supervening paralysis. Extensive paralysis, progressing after the first 24 hours, is usually a serious prognostic sign.

The chance of complete recovery—restoration of paralyzed parts to their normal function—is greater than has been commonly supposed. In Massachusetts in 1909, 62 of the 628 paralyzed cases (=10 per cent) were reported as recovered within a year. Out of 150 cases closely studied, 25 (=16.7 per cent) were found completely recovered after 3 days to 12 weeks. The extent of paralysis in these cases is given as follows: One thigh and leg, 4; both thighs and legs, 8; both thighs, 1; one leg, 2; one arm, 1; one leg, arm, and back, 1; one leg and back, 1; one thigh, leg, arm, and forearm, 1; one arm, forearm, and cervical region, 1; cervical region, 4; indefinite staggering gait, 1. It is shown by the above that some of these cases had been quite extensively paralyzed.

Complete recovery was recorded in 40 out of 754 cases (=5.3 per cent) investigated in the New York epidemic of 1907; and "almost complete disappearance of paralysis" in 13 (=1.8 per cent), giving a total of 53 cases (=7.1 per cent) making a practically complete recovery.

Hill[1] states that 15 per cent of 283 cases occurring in Minnesota during 1909 completely recovered within a year. Since 24 per cent of these 283 cases died, the 15 per cent of recoveries is equivalent to 19.2 per cent of recoveries among those who survived.

NOTE.—Since this paper went to press, Osgood and Lucas (Journ. Am. Med. Assn., Feb. 18, 1911, vol. 56, p. 495) have reported experiments demonstrating that the nasal mucous membrane of two monkeys, experimentally inoculated with poliomyelitis, remained infectious for six weeks and five and one-half months, respectively. This very important observation strengthens the suspicion of the existence of human "carriers," who may play an important part in the epidemiology of poliomyelitis. It raises still further doubts as to the efficiency of prophylactic measures directed only to persons in the acute stage.

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LIST OF PUBLIC HEALTH BULLETINS.

The following is a list of the Public Health Bulletins that have been issued:

*1. Report on Trichinæ and Trichinosis. By W. C. W. Glazier. 1881. 212 pages. 87 il. 1 map. Paper. Senate Executive Document No. 9, Forty-sixth Congress, third session. Out of print.

*2. Report on the Etiology and Prevention of Yellow Fever. By George M. Sternberg. 1890. 271 pages. 21 pl. 20 il. Cloth. Out of print.

3. Mortality Statistics in the United States for the year ending December 31, 1897. From Annual Report Marine-Hospital Service, 1898. 24 pages. Paper.

4. Yellow Fever: Its Nature, Diagnosis, Treatment, and Prophylaxis and Quarantine Regulations Relating thereto. By officers of the Marine-Hospital Service. Reprint from Annual Report Marine-Hospital Service, 1898. 176 pages. 1 il. Paper.

*5. Shipment of Merchandise from a Town infected with Yellow Fever. By H. R. Carter. 1899. 15 pages. Paper. Out of print.

6. Report of Commission of Medical Officers detailed by authority of the President to Investigate the Cause of Yellow Fever. By Eugene Wasdin and H. D. Geddings. July, 1899. 98 pages. 26 charts. 2 il. Paper.

*7. The Bubonic Plague. By Walter Wyman. January, 1900. 50 pages. Paper. Superintendent of Documents, 5 cents.

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18. Transactions of the Fifth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. May, 1907. 47 pages. Cloth.

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*20. The Public Health and Marine-Hospital Service of the United States. A Brief History. Prepared for the Jamestown Ter-Centennial Exposition. 1907. 12 pages. Paper. Out of print.

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*22. The Present Pandemic of Plague. By J. M. Eager. 1908. 30 pages. Paper. Out of print.

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    9. Rodents in Relation to the Transmission of Bubonic Plague. By Rupert Blue.
    10. Rodent Extermination. Rats and Mice. By W. C. Rucker.
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TREASURY DEPARTMENT
Public Health and Marine-Hospital Service of the United States

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A DIGEST OF THE LAWS AND REGULATIONS OF THE VARIOUS STATES RELATING TO THE REPORTING OF CASES OF SICKNESS

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A DIGEST OF THE LAWS AND REGULATIONS OF THE VARIOUS STATES RELATING TO THE REPORTING OF CASES OF SICKNESS.

By John W. Trask,
Assistant Surgeon General.

Reports of sickness are a necessity in public health work. Even a casual consideration of the subject will show that they are the foundation upon which public health work depends for its success. Accepting the function of the health officer as being the prevention of disease, a knowledge of the prevalence and geographic distribution of the preventable diseases within his jurisdiction is essential to his work. This knowledge is possible only in so far as cases of sickness are reported.

As our knowledge of pathology and epidemiology increases, additions are being constantly made to the diseases classed as preventable. It has long been recognized that certain of the more common contagious diseases, such as smallpox, scarlet fever, diphtheria, and measles should be reported, that proper restraint, isolation, or other indicated measures may be enforced for the protection of the community, or the public warned of possible danger. A community which has no means of knowing with what contagious diseases it is afflicted nor how many cases there are, nor where they are, is helpless to protect itself, and unnecessary sickness and deaths will result. Generally speaking, every case of an infectious disease is a focus from which other cases may directly or indirectly arise unless measures are taken to prevent them. Every typhoid-fever patient has potential possibilities for harm through the contamination of water and food supplies, which may be so far-reaching that it is but proper that cognizance be taken of each case. The same is true of tuberculosis, with the exception that its manner of spread is somewhat different. The majority of cases of this disease receive their infection from some existing human case. The disease is more or less chronic in character and the patient usually continues as a focus from which infection may be spread for months and sometimes years. If tuberculosis, which has so sorely affected mankind, is to be made a constantly diminishing factor as a cause of unnecessary sickness and premature death,

the location and activities of those affected must be known that they may be properly instructed how to conduct themselves that others may not be unduly endangered, that they may learn the ethical code to which the tuberculous should conform, and that its observance may be made as effective and easy as present knowledge can make it. Yellow fever is a disease of quite another type, spread in an entirely different way, but the importance of having each case reported at the earliest possible time has made a profound impression, and deservedly so, upon those living in infectible territory. And yet the ravages of this disease by sickness and death, while more striking perhaps, are no greater than those of some other diseases which are more constantly present and which very probably might be as effectively curtailed if as strenuously combated.

The above-named diseases serve as a few commonplace examples to illustrate the fundamental need for the reporting of the preventable diseases. The general statement may be made, it is believed, that in order to prevent the undue spread of the infectious diseases of man it is necessary that existing cases be reported to some authority with power and facilities to take such measures as are necessary to prevent the spread of the infection to others; also that the reporting of cases is the only generally reliable means a community has of knowing when unusual disease conditions or epidemics exist, and when, therefore, greater effort must be made for protection. The reporting of all cases of certain diseases occurring on water sheds is necessary for the proper protection of water supplies. The reporting of all cases of sickness possible of spread through milk when they occur at places where milk is produced, handled, or distributed, is essential to prevent epidemics of milk-borne disease.

Whenever it is desired to make a careful study of the cause of an epidemic, or of an unusual prevalence of a disease, the first step is to study the known cases to find the factors which have been operative in spreading the infection. Better results would undoubtedly be attained if, instead of unusual conditions being necessary as an incentive to epidemiological studies, every health authority had the means for constantly studying the movements of disease within his jurisdiction, the exacerbation and decline of sickness, the factors operative in the causation of disease, the best methods of prevention, and the times when special effort is necessary or most effective.

COLLECTION OF REPORTS.

The regulation of the reporting of sickness comes within the police powers of the individual States. As the sanitary condition of a State affects not only the inhabitants of the State itself, but, because of interstate commercial relations made easy by good roads and rapid transit, affects neighboring States, and even those more remote,

it would seem that it might reasonably be considered as having become the duty as well as the privilege of the individual States to meet the responsibility to such a degree at least as will guarantee a reasonable protection to other States. The minimum which would appear to serve this purpose would be that each State take measures to keep itself informed as to the prevalence and geographic distribution of the communicable diseases within its territory and make this information available at frequent intervals to those interested.

A State board or department of health, to be responsible for the local enforcement of State laws, must be represented locally by officials over which it has not only nominal but some actual supervision. This end has been accomplished in various ways. Some States (Massachusetts and Pennsylvania) have divided the State into health districts and placed a State representative in each. In Pennsylvania the county has practically been made the district. In Florida agents of the State board are employed in most of the counties. This gives the State board or department a representative, to a certain extent local in character. In Pennsylvania the actual local authority of the State has been carried still further, and all townships in which no township board of health has been organized are placed under employees of the State department of health, who act as local health officers. The State law requires incorporated municipalities and townships having a certain density of population (300 to the square mile) to organize local boards of health. All townships not so supplied, which in a way represent the strictly rural territory, are under the direct and immediate control of the State department of health.

In certain of the States a partial control over local boards has been obtained by the State authorities appointing a majority of the members of each local board. In Virginia the State board appoints three of the four members of each county and city board of health, and one of the three so appointed becomes the local health officer. In South Dakota the State board appoints two of the three members of each county board of health, but takes no part in the appointment of city boards. In West Virginia the State board appoints three of the five members of each county and city board of health; the three so appointed are nominated, however, by the county court in the case of counties and the council in cities. In Oklahoma the State commissioner of health appoints a county superintendent of health for each county. In Vermont the State board appoints a health officer for each town (township). In Wyoming the State board appoints the county health officers.

The health officer's knowledge of the prevalence or course of disease depends mainly upon reports made by physicians, the part played by the practicing physician being the most important factor

in securing reports of sickness. Physicians have not always been prompt in doing their part. It would seem, however, that if they are to avoid the unjust criticism of not being interested in prophylaxis, they must espouse the cause of preventive medicine and become, by virtue of their humanitarian calling, ex officio assistants of the health authorities. This idea appears to have been instrumental in shaping certain of the State laws. In Alabama the Medical Association of the State of Alabama constitutes the State board of health, and elects the State health officer. The county medical society constitutes a board of health for the county, and elects the county health officer and health officers for each incorporated municipality. In Mississippi the State medical association and all medical societies in affiliation with it constitute the State department of health, and any licensed practitioner of medicine may have his name enrolled as a member of the department. In North Carolina all registered physicians in each county constitute an auxiliary board of health for the county, the function of this board being to advise the county authorities on sanitary matters. In South Carolina the State board of health consists of the South Carolina Medical Association together with certain of the State officials.

Aside, however, from a consideration of the subject on a professional ethical basis, most physicians, because of their position as citizens, would without doubt desire to conform to the law once it had occurred to them that failure to do so placed them outside the class of law-abiding citizens. It would seem that where the State issues licenses, permitting the practice of medicine, one of the most reasonable penalties which it might be expected to impose upon physicians who did not comply with the laws, would be the suspension or revocation of the license. It is believed that a considerable percentage of those who do not now feel under moral obligation to carefully and accurately report all cases required by law would do so if it were made plain that the license was granted on condition that the recipient agreed to familiarize himself with State laws relating to the public health and to obey them, and that the license would be considered valid only so long as these conditions were fulfilled.

This has been enacted into law in Utah, where it is required that whenever any licensed practitioner of medicine is guilty of willful violation of the law in regard to the reporting of infectious diseases or the registration of births and deaths his license shall be revoked or canceled. (Utah Compiled Laws, 1907, sec. 1735-36 as amended by Acts of 1911, ch. 93.)

The question naturally arises as to which diseases should be made notifiable. Opinion in the past seems to have differed considerably. The number required to be reported varies from 33 in Pennsylvania to none at all in four States. There would seem to be decided

advantages in making notifiable all preventable diseases, and that these might be considered to include infectious diseases, certain parasitic diseases, occupation diseases, and certain diseases due to damaged or improper food.

The greatest need of reports of sickness, and their most important use, are for the immediate information of the health officer, that he may take such measures as are known to medical science to protect the family of the patient and the community from further and unnecessary infection or additional injury, or at least instruct them as to how this can be done. However, reports of sickness when compiled and classified become morbidity statistics which show the movement of disease, the progression, extension, recession, and periodicity of epidemics, and the effects upon disease of preventive measures and sanitary improvements.

The reporting of sickness is the foundation upon which the study of epidemiology necessarily rests, a study which will without doubt add much to existing knowledge of disease.

STATE LAWS AND REGULATIONS.

The laws and regulations of the various States relating to the reporting of sickness, and to the health authorities to and through whom the reports of cases are made, briefly abstracted and analyzed in tabular form, will be found on succeeding pages. It is desired to emphasize that these represent the requirements of State statutes and of regulations promulgated in accordance with the statutes, and are not to be understood as showing in all cases the work that is done, owing to the impossibility of enforcement of the provisions under existing conditions in some of the States. For some purposes it would have been better to have shown the measures being enforced and the extent of their enforcement, but for reasons which will be readily understood this was impossible.

There is considerable variation in the different States as to the authority to whom reports are made. The simplest and least common is where the physician makes the report direct to the State board or department of health. The most common is for the physician to report to the city health authority, if in a city, and to the township or county authority if outside of cities, and for the city and township or county authorities to report to the State department or board. In some States a third step is inserted and the local authorities report to the county health officer who in turn reports to the State. Various modifications of these schemes are also used, as will be seen by consulting the tables. The effort seems to have been made in most cases to have the physician report to the authority who would be benefited by the information and would take whatever action was necessary or possible.

The time when reports are to be made also varies. It is usually required that the physician make an immediate report; in some cases it is specified to be made within 12 or 24 hours, in others weekly, and in still others at the end of the month. Also varying requirements are made as to when the city, township, and county authorities shall report to the State. In some States these reports are made daily, in some weekly, in others semimonthly or monthly, in a few quarterly, annually, or not at all; in one or two weekly and also for the fraction of a week at the end of the month.

The variation in the laws and regulations of the States as to the manner and time of reporting, and the authorities to whom the reports are made, is such that the only method of satisfactorily showing the details seemed to be a tabular statement where the scheme adopted in each State could be shown. (See pp. 74 to 97, inclusive.)

The features peculiar to the various State laws have been noted by themselves as being of possible interest, and will be found on pages 66 to 68, inclusive.

A table showing the diseases required to be reported in each State will be found on pages 69 to 73.

ACKNOWLEDGMENT.

A copy of the proof of this publication was sent to the State health officer or secretary of the State board of health of each of the several States for criticism, and the indication of errors or omissions which might be noted. Replies containing helpful suggestions and in many instances corrections and additions were received from practically all. Many also went to great pains to forward copies of regulations and recently enacted laws.

It is a pleasure to acknowledge the assistance and cooperation of those who thus made possible a work which it is trusted will be found useful in making the various State requirements for the reporting of sickness easily accessible.

ABSTRACTS OF THE STATE AND TERRITORIAL LAWS AND REGULATIONS RELATING TO THE REPORTING OF SICKNESS AND THE HEALTH AUTHORITIES TO AND THROUGH WHOM CASES ARE REPORTED.

ALABAMA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The Medical Association of the State of Alabama is the State board of health, and elects an executive officer, known as the State health officer. (Political Code of 1907, ch. 22, Art. I.)

Counties.—The county medical societies in affiliation with the Medical Association of the State of Alabama are boards of health for their respective counties, and for all incorporated towns and cities therein, and are under the general supervision of the State board of health. The county board of health is the only local board of health. Others are prohibited. The county board elects a county health officer, and a health officer for every incorporated city and town in the county. (Ibid.)

MORBIDITY REPORTS.

Notifiable diseases.—Leprosy, cholera, typhus fever, cerebro-spinal meningitis, yellow fever, scarlet fever, plague, hydrophobia, glanders, smallpox, diphtheria, pulmonary tuberculosis, typhoid fever, chagres fever, beriberi. (Ibid., sec. 716.)

Physicians, etc.—Physicians are required to report cases of the above-named diseases occurring in their practice to the local health officer. (Ibid., sec. 714.) Midwives and other persons are to report in like manner suspected cases. (Ibid., sec. 715.)

Municipal health officers.—Municipal health officers are required to keep a "Register of infectious diseases," in which are recorded the name, age, sex, color, race, occupation, and residence of persons attacked by the above-named diseases. The presence of any of these diseases is to be reported promptly to the committee of public health of the county board of health and to the State health officer. (Ibid., sec. 710.)

County health officers.—County health officers also keep a "Register of infectious diseases," in which are recorded cases reported to them. They are required to report to the State health officer the presence of any of the reportable diseases in their respective counties. (Ibid., sec. 706.)

ARIZONA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

Territory.—The governor appoints a superintendent of public health, who, together with the governor and the attorney general, constitutes the Territorial board of health. (Acts of 1903, ch. 65.)

Counties.—The board of supervisors of the county appoints a superintendent of public health, who, with the chairman of the board of supervisors and the district attorney of the county, constitutes a county board of health, having jurisdiction outside of cities possessing a board of health. (Ibid.)

Cities.—The mayor of each city appoints two members of the city council, who, together with the city engineer and the health officer, constitute the city board of health. (Ibid.)

MORBIDITY REPORTS.

Physicians, etc.—Physicians and other persons are required to report immediately to the local board of health all cases of contagious, epidemic, or infectious diseases coming to their knowledge. (Acts of 1903, ch. 65, sec. 24.)

Keepers of private houses, boarding houses, lodging houses, inns, or hotels are required to report within 24 hours to the local board of health cases of contagious, infectious, or epidemic disease which may occur in their houses, inns, or hotels. (Ibid., sec. 26.)

Local boards of health.—It is the duty of the local boards of health whenever it comes to their knowledge that a case of smallpox, scarlet fever, diphtheria, or other infectious or contagious disease exists within their jurisdiction, to report immediately to the Territorial board of health the existence and nature of such disease. (Ibid., sec. 31.)

The county superintendent of health is to report immediately to the Territorial superintendent of health whenever any case of contagious or infectious disease occurs in his county. (Ibid., sec. 7.)

ARKANSAS.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The State board of health consists of six commissioners of health appointed by the governor. The majority of the board consists of physicians. (Digest of Statutes, 1904, Kirby, sec. 534.) The board elects from its personnel or otherwise a person to be secretary and executive officer. (Ibid., sec. 536.)

Counties.—The several county judges may appoint county boards of health for their respective counties, these boards to be composed of three physicians. (Ibid., sec. 546.)

Cities.—In cities of the first (population over 5,000) and second (population between 2,500 and 5,000) classes the city council has the power to establish a board of health with jurisdiction extending 1 mile beyond the city limits, and for quarantine purposes, in case of epidemic, 5 miles. (Ibid., sec. 5525.)

MORBIDITY REPORTS.

The law states that it shall be the duty of the State board of health to have general supervision of the State system of the registration of prevalent diseases, and that the board shall prepare the necessary methods and forms for obtaining and preserving such records and to insure the faithful registration of the same in the several counties. The secretary of the State board of health is the superintendent of registration of vital statistics of the State. (Ibid., sec. 540.)

CALIFORNIA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—There is a board of health consisting of seven physicians appointed by the governor. (Political Code, 1909, Deering, sec. 2978.)

Counties.—The boards of supervisors in their respective counties appoint a health officer whose duty it is to enforce the orders of the board of supervisors and the State board of health. When public necessity requires, the board of supervisors may appoint a special health officer for any unincorporated town. (Ibid., sec. 4225.)

San Francisco: The board of health consists of the mayor of the city and county, and four physicians appointed by the governor. This board elects a health officer. (Ibid., secs. 3005, 3007.)

Sacramento: The board of trustees has established by ordinance a board of health, consisting of five physicians. (Ibid., sec. 3042.)

Cities of the first class: Cities having over 200,000 inhabitants are termed cities of the first class. Those having between 100,000 and 200,000 are cities of the first and a half class. These cities are entitled the city of ———, or the city and county of ———, as the case may be, and are required to have a board of health consisting of the mayor of the city, or the city and county, and five physicians appointed by the governor. (General Laws, California, 1910, Bender-Moss Co., Act No. 2348, sec. 165.)

Cities and towns: It is the duty of the board of trustees, council, or other corresponding board, of every incorporated town and city, to establish by ordinance a board of health for the town or city, consisting of five persons, one at least of whom shall be a physician, and one, if practicable, a civil engineer. (Political Code, 1909, Deering, sec. 3061.)

The board of supervisors for each county must appoint in each unincorporated city and town having 500 or more inhabitants, a health officer. (Ibid., sec. 3062.) The county board of supervisors may appoint a special health officer for unincorporated towns when public necessity requires. (Ibid., sec. 4225.)

MORBIDITY REPORTS.

Notifiable diseases.—Cholera, plague, yellow fever, leprosy, diphtheria, scarlet fever, smallpox, typhus fever, typhoid fever, anthrax, glanders, epidemic cerebro-spinal meningitis, tuberculosis, pneumonia, dysentery, erysipelas, uncinariasis (or hookworm), trachoma, dengue, tetanus, measles, German measles, chickenpox, whooping cough, mumps, pellagra, beriberi, syphilis, gonococcus infection,

rabies, poliomyelitis. (Ibid., sec. 2979a, as amended by sec. 1, ch. 250, Laws 1911.)

Physicians.—It is the duty of every attending or consulting physician, nurse or other person having charge of or caring for any person afflicted with any of the above-named diseases to report at once in writing to the local board of health or health officer the nature of the disease and name and residence of patient excepting that syphilis and gonococcus infection are to be reported by office number only. (Ibid.)

The public-health law of 1907 requires that physicians, nurses, clergymen, attendants, owners, proprietors, managers, employees, and persons living in or visiting any sick person in any hotel, lodging house, house, building, office, structure or other place where any person is ill of any infectious, contagious, or communicable disease, promptly report such fact to the city, city and county, or other local health board or health officer, giving the name of the person, if known, the place where such person is confined, and the nature of the disease. (Acts of 1907, ch. 492, sec. 16.)

Medical practitioners attending or called in to visit a patient, whom he believes to be suffering from poisoning by lead, phosphorus, arsenic, or mercury, or their compounds, or from anthrax, or from compressed-air illness, contracted as a result of the nature of the patient's employment, are required to send to the State board of health a notice stating the name, address, and place of employment of the patient and name of the disease, and for this report the practitioner is entitled to a fee of 50 cents. (The State board of health is to transmit the data thus obtained to the State commissioner of the bureau of labor statistics.) (Acts of 1911, ch. 485, secs. 1 and 3.)

Local health authorities.—It is the duty of every coroner, local health officer, and every member of the local boards of health, to report at once in writing cases of the above-named diseases and of any other contagious or infectious disease to the secretary of the State board of health. (Political Code, sec. 2979a, as amended by sec. 1, ch. 250, Acts of 1911.)

Every county health officer, and every city and county, city or town board of health, or chief executive health officer, is to report in writing to the State board of health on or before the 5th day of each month, and also whenever requested by the State board of health or its secretary all infectious, contagious, and communicable diseases in man or beast which come to his knowledge, the report to be made on blanks furnished by the State board of health. (Acts of 1907, ch. 492, sec. 11.)

Local boards of health or health officers are to report immediately by telegraph to the secretary of the State board of health every case of plague, Asiatic cholera, yellow fever, or typhus fever, and after investigation and within 24 hours are to further report the cause, source, and extent of the infection and the measures adopted in each case. (Acts of 1907, sec. 13, ch. 492, as amended by sec. 3, ch. 339, Acts of 1911.)

In addition to the diseases previously enumerated, cases of malaria are to be promptly reported to the State board of health. (Ibid.)

COLORADO.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of nine members, appointed by the governor. (Rev. Stat., 1908, ch. 115, sec. 5009.)

Counties.—The board of county commissioners of each county constitutes a board of health for the county with jurisdiction outside of cities, towns, and villages. The board appoints a health officer. (Ibid., sec. 5030.)

Incorporated cities and towns.—The mayor and council or trustees of each incorporated city and town constitute a board of health for the city or town. The board appoints a health officer. (Ibid., secs. 5031, 5032.)

MORBIDITY REPORTS.

Householders.—Whenever a householder knows that a person within his family is ill with smallpox or any other disease dangerous to the public health, he is required to report the case to the local (city or county) health officer immediately. (Ibid., sec. 5070.)

Physicians.—Physicians must report immediately to the local board of health all cases of smallpox, cholera, diphtheria, scarlet fever, or other disease dangerous to the public health occurring in their practice. They must also report the case to the householder, hotel keeper, keeper of a boarding house or tenant within whose house or rooms the sick person happens to be. The notice to the board of health must state the name of the disease, the age and sex of the person sick, the address of the patient, and the name of the physician giving the notice. (Ibid., sec. 5072.)

Local boards of health.—City and county health officers are required by law to keep the secretary of the State board of health constantly informed respecting every outbreak of a disease dangerous to the public health. (Ibid., sec. 5073.)

CONNECTICUT.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of seven members, six appointed by the governor, of whom three must be physicians, and one a lawyer, and a secretary chosen by the six so appointed. (General Statutes, 1902, sec. 2502.)

Counties.—The judges of the superior court appoint an attorney at law to be health officer for each county. (Ibid., sec. 2517.)

Towns (townships).—The county health officer appoints a person learned in medical and sanitary science to be health officer for each town, except in towns containing a city or borough whose limits are coterminous with the town limits. In towns containing a city or borough, whose limits are not coterminous with those of the town, the town health officer has jurisdiction in the town only outside of the limits of the contained city or borough. (Ibid., sec. 2521.)

Cities and boroughs.—The mayor of every city, and the warden of every borough is required to appoint a person learned in medical and sanitary science to be health officer for the city or borough, unless the charter of the city or borough makes other provision for the appointment of a health officer. (Public Acts, 1905, ch. 15.)

MORBIDITY REPORTS.

Physicians.—Physicians are required to report in writing every case of cholera, yellow fever, typhus fever, leprosy, smallpox, diphtheria, membranous croup, typhoid fever, scarlet fever, or of other contagious or infectious disease, except those of a venereal nature, occurring in their practice, to the health officer of the town, city, or borough in which the case occurs, within 12 hours after the nature of the disease has been recognized. (Connecticut General Statutes, 1902, title 15, ch. 150, sec. 2534.) Physicians are required to report in writing the name, age, sex, color, occupation, place where last employed, and address of all cases of tuberculosis in their practice to the health officer of the city, town, or borough within 24 hours. (Public Acts, 1909, ch. 79, sec. 1.)

The secretary of the State board of health states that, in addition to the State laws and regulations, uniform sanitary regulations have been adopted by all the towns (townships) in the State which require that physicians shall report in writing to the town health officer within 12 hours every case of cerebro-spinal fever, whooping cough, and measles, in addition to the diseases above named, and that when no physician is in attendance householders are to report cases occurring in their houses.

Hotel and lodging house keepers.—Hotel and lodging house keepers are required to report to the local board of health within 12 hours cases of malignant or contagious disease occurring in their houses. (General Statutes, 1902, sec. 2546.)

Midwives, nurses, etc.—The midwife, nurse, or attendant having charge of an infant under two weeks of age is to report in writing within six hours to the local health officer whenever the infant's eyes become reddened, inflamed, or swollen. (Ibid., sec. 2535.)

Institutions.—Officers in charge of hospitals, dispensaries, asylums, and other similar institutions, are required to report cases of tuberculosis coming under their care or observation to the local health officer within 24 hours in the same manner as practicing physicians. (Public Acts, 1909, ch. 79, sec. 1.)

Local health officers.—When in any town, city, or borough, a case of smallpox, cholera, or any epidemic of infectious disease is known to exist, the local health officer is required to immediately notify the secretary of the State board of health of the existence of the same. (General Statutes, 1902, sec. 2508.)

The health officer of every town, city, and borough is required to make a report to the State board of health on or before the 8th day of each month of all contagious diseases reported to him during the preceding month. (Ibid., sec. 2532.)

Local health officers report to the commissioner of domestic animals cases of rabies within 24 hours after receiving information of such cases. (Public Acts, 1907, ch. 170, sec. 1.)

DELAWARE.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of seven physicians appointed by the governor. They elect a secretary who may

be a member of the board. (Laws of Delaware, vol. 19, ch. 642, sec. 1; also Rev. Stat., 1893, p. 296.)

Counties.—The governor appoints three physicians in each county to be health officers of the county. (Rev. Stat., 1893, ch. 46, p. 362.)

Cities.—It is the duty of the common council of every city and the commissioners of every incorporated town to appoint a board of health for the city or town of not less than three nor more than seven members, of whom at least one shall be a physician. (Delaware Laws, vol. 16, ch. 345, sec. 1; also Rev. Stat., 1893, p. 298.)

MORBIDITY REPORTS.

Physicians, etc.—Physicians, dentists, veterinary surgeons, or others practicing medicine or surgery or any branch thereof are required to give prompt notice to the local or State board of health of any and all cases of contagious or infectious diseases that come under their professional notice. (Acts of 1899, ch. 240, sec. 4, and Acts of 1903, ch. 327, sec. 6.)

Any physician or other person having knowledge of a case of disease dangerous to the public health which the State board of health requires to be reported is required to report the name, age, sex, and color of the patient and the place where the patient may be found to the health authority nearest to his place of residence. (Acts of 1903, ch. 328, sec. 3.)

Local health authorities.—It is the duty of the local boards of health to report to the State board of health the existence of any case of infectious or contagious disease which may come under their observation. (Acts of 1903, ch. 327, sec. 6.)

DISTRICT OF COLUMBIA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

District.—The Commissioners of the District appoint a physician as health officer. (20 Stat. L., p. 107; 1 Sup. R. S., 2d ed., p. 179.)

MORBIDITY REPORTS.

Notifiable diseases.—(1) Asiatic cholera, (2) yellow fever, (3) typhus fever, (4) smallpox, (5) leprosy, (6) the plague, and (7) glanders (29 Stat. L., p. 635), (8) diphtheria, (9) scarlet fever, (10) measles, (11) whooping cough, (12) chicken pox, (13) epidemic cerebro-spinal meningitis, and (14) typhoid fever (34 Stat. L., p. 889), (15) tuberculosis (35 Stat. L., pt. 1, ch. 165, p. 126).

Physicians or persons in charge.—Physicians or persons in charge of cases shall report immediately to the health officer cases of the diseases (1 to 7) enumerated above, giving the name of the disease, name, age, sex, and color of the person suffering therefrom, and address where located. (29 Stat. L., p. 635.)

Physician, head of family, etc.—Every person in charge of any patient suffering from any of the diseases (8 to 14) enumerated above, is required to send to the health officer a signed certificate written in ink, stating the name of the disease, the name, age, sex,

and color of the person suffering therefrom, the school attended, and the address where the patient can be found. When the patient recovers or dies, the person in charge is required to send to the health officer as soon as possible an ink-written certificate of the fact.

The term "person in charge" is held to mean, first, each physician in attendance, and in the absence or default of the physician, then, second, the head of the family to which the patient belongs; third, the nearest relative present on the premises, and fourth, every person in attendance. (34 Stat. L., p. 889.)

Poliomyelitis is to be reported in the same manner as the above-named diseases 8 to 14, and, in addition, when the temperature of the patient returns to normal, or if it has not been above normal, the fact is to be reported. (Regulations, Commissioners of the District of Columbia, May 3, 1911.)

Officers having charge of hospitals, dispensaries, asylums, and similar institutions and physicians are required to report to the health officer cases of pulmonary or other communicable form of tuberculosis within one week after the disease is recognized. (35 Stat. L., pt. 1, p. 126.)

Midwives, nurses, etc.—Whenever any midwife, or any person other than a registered physician, is in attendance upon a case of childbirth, and the newly born child has inflammation of the eyes, attended by a discharge therefrom, said midwife or other person is required to report the fact in writing to the health officer, so that the report shall be received by the health officer within the six hours after the existence of the discharge becomes known. (Regulation, Aug. 25, 1911.)

FLORIDA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—There is a State board of health of three members appointed by the governor. This board designates and employs a physician as State health officer, who is also the board's executive officer and secretary. (General Statutes, 1906, secs. 1109, 1112.)

Counties.—The State board of health is given power to make rules and regulations for the preservation of the public health (General Statutes, 1906, sec. 1120), and the supervision and regulation of municipal and county sanitation. (Laws of 1909, ch. 5931, sec. 1.) The State health officer is authorized to employ suitable persons to serve as county sanitary agents, or special agents, or in such other capacities as may be necessary to carry out the powers and duties of the State board of health. (Rule 34, Florida State board of health.) Up to June 12, 1911, there had been 41 agents appointed in 39 counties. (The State contains 47 counties.) Thirty-four counties had 1 agent each, 3 counties 2 agents each, and 1 agent served for 2 counties. (State health officer, June 12, 1911.)

NOTE.—Charters granted to cities by the legislature usually make provision for city health officers.

MORBIDITY REPORTS.

Physicians.—It is the duty of physicians to report immediately to the president of the State board of health by telegram, or in the most expeditious manner, every case of yellow fever, smallpox, or cholera

that comes within his practice, the telegram to be paid for by the State. (General Statutes, 1906, sec. 1114.) Immediate report to be made also to the city health officer or mayor or the county physician or chairman of the county commissioners. (Ibid., sec. 1146.)

It is also the duty of physicians to report immediately to the State health officer or to an agent of the State board of health, by first mail, every case of diphtheria, leprosy, or scarlet fever which he may be called to attend. Where there is no physician in attendance upon such a case, it is the duty of any person having charge of, or in attendance upon, or upon whose premises the case occurs, to report in the same manner as required of physicians. (Rules and regulations of State board of health, 1904, rule 28.)

The State board of health in annual session in February, 1911, revised the rules and regulations of the board, and it is believed that they will be approved finally and made effective in February, 1912.[1] Rule 1 relating to the reporting of cases of sickness, as revised, reads:

Rule 1. Reports of communicable diseases.—It shall be the duty of every physician in the State of Florida to report immediately to the State health officer or to a representative of the State board of health, by first mail, every case of scarlet fever, diphtheria, measles, cerebro-spinal meningitis, anterior poliomyelitis, bubonic plague, glanders, anthrax, rabies, or leprosy, which occurs within his practice or which he may be called to attend. (Yellow fever, smallpox, and cholera are to be reported by telegram, charges collect. See section 1114, General Statutes, 1906. All other diseases should be reported by first mail, or by paid telegram.) Where there is no physician in attendance upon any case of the diseases herein mentioned, it shall be the duty of any person having charge of or in attendance upon, or upon whose premises a case of such diseases is suspected to exist, to report the same in the manner herein provided.

GEORGIA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS

State.—The law makes provision for a State board of health of 12 members, 11 of whom shall be physicians, appointed by the governor, the twelfth being the secretary. (Acts of 1903, No. 453, sec. 1.)

Counties.—The authorities of each county are authorized and requested to establish a board of health, and appoint a health officer, the board to have jurisdiction outside of municipalities. (Regulations, State board of health, 1904, secs. 46, 50.)

Cities.—The council of each incorporated city and town is authorized and requested to establish a board of health and elect a health officer. (Regulations State board of health, 1904, secs. 46, 48.)

Unincorporated cities and towns are put under the supervision of the county boards of health. (Regulations, State board of health, 1904, sec. 46.)

In case a city or county fails to establish a board of health, the State board of health may appoint a health officer for the city or county. (Regulations, State board of health, 1904, sec. 46.)

[1] Letter of State health officer, Oct. 30, 1911.

MORBIDITY REPORTS.

Notifiable diseases.—The State board of health has declared the following-named diseases to be dangerous to the public health: Smallpox, Asiatic cholera, yellow fever, typhus fever, scarlet fever, diphtheria, and membranous croup. (Regulations, State board of health, 1904, sec. 9.)

Physicians, etc.—Physicians, householders, heads of families, county or municipal authorities aware of the existence of any of the abovenamed diseases are required to report them immediately to the local board of health or its proper officer. (Regulations, State board of health, 1904, sec. 9.)

Local boards of health.—It is the duty of local boards of health and of physicians in localities where there are no health authorities to report promptly to the State board of health the discovery of any of the following-named diseases: Asiatic cholera, yellow fever, scarlet fever, smallpox, diphtheria, typhus fever, typhoid fever, and such other contagious or infectious diseases, as the State board of health may from time to time specify. (Acts of 1903, No. 453, sec. 5.)

County and municipal health officers are required to keep a record of all cases of contagious or infectious diseases reported to them. (Regulations State board of health, 1904, sec. 49.)

HAWAII.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

Territory.—Provision is made for a Territorial board of health consisting of seven members appointed by the governor, four to be laymen, two physicians, and the seventh to be the attorney general. All the members serve without pay except the president of the board. (Revised Laws, 1905, sec. 988.)

The board of health may appoint suitable agents in such localities as it may deem necessary to carry into effect all regulations for the public health. (Ibid., sec. 990.)

MORBIDITY REPORTS.

Notifiable diseases.—Cerebro-spinal meningitis, Asiatic cholera, follicular conjunctivitis, diphtheria, amœbic dysentery, typhoid fever, paratyphoid fever, leprosy, measles, dengue, poliomyelitis, whooping cough, plague, scarlet fever, tetanus, trachoma, tuberculosis, typhus fever, chicken pox, smallpox, yellow fever, or any other infectious or communicable disease, or disease dangerous to the public health. (Ibid., secs. 1004, 1005, 1005A, as amended by laws of 1911, act 125.)

Physicians.—Physicians are required to report immediately to the board of health or its nearest agent in writing cases of the abovenamed notifiable diseases, or of any other infectious or communicable disease, or disease dangerous to the public health. In addition to the written report, cases of smallpox, scarlet fever, diphtheria, plague, cholera, yellow fever, typhus fever, cerebro-spinal meningitis, and amœbic dysentery are to be reported immediately by telephone or direct oral communication. The recovery of cases of tuber-

culosis is also to be reported. (Ibid., sec. 1004, as amended by laws of 1911, act 125. Also laws of 1911, act 118, secs. 7 and 15.)

Institutions.—Superintendents in charge of hospitals, dispensaries, asylums, or other similar private or public institutions are to report to the board of health or its nearest agent within 24 hours, giving the name, age, sex, nationality, occupation, place where last employed, if known, and previous address of every patient having tuberculosis who comes into their care or under their observation. (Laws of 1911, act 118, sec. 7.)

Householders, etc.—Householders, keepers of boarding and lodging houses, and masters of vessels are to report immediately to the board of health or its nearest agent any person in or about their respective houses or vessels whom they believe to be sick with a notifiable disease. Police officers are also to report immediately to the board of health or its nearest agent cases of the notifiable diseases coming under their observation. (Ibid., sec. 1005, as amended by laws of 1911, act 125, sec. 2.)

Every person.—It is the duty of every person to report to the board of health or its agent forthwith every case known or believed to be leprosy. (Ibid., sec. 1124 and acts of 1909, chap. 81, sec. 3.)

The board of health is required during the prevalence of any severe pestilence or epidemic to publish weekly a report of the public health. (Revised Laws, 1905, sec. 988.)

IDAHO.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of five members as follows: Two physicians appointed by the governor, the attorney general of the State, the State engineer, and a physician elected as secretary of the board by the other four members. (Revised Political Code, 1908, title 8, ch. 1, art. 1, p. 529.)

Counties.—The board of county commissioners and the county physician constitute a county board of health, the county physician being secretary and the executive officer of the board. (Ibid., art. 3, p. 534.)

Cities.—Rule VIII of the rules and regulations of the State board of health (May, 1909), requires that the county boards of health shall insist on the organization of municipal boards of health in incorporated towns and villages within their respective counties.

MORBIDITY REPORTS.

Notifiable diseases.—Rule X of the rules and regulations of the State board of health (May, 1909), declares the following-named diseases to be dangerous and contagious: Asiatic cholera, yellow fever, smallpox, chicken pox, typhus fever, leprosy, bubonic plague, diphtheria, scarlet fever, typhoid fever, measles (including rothelu), and whooping cough. Cerebro-spinal meningitis and "infantile paralysis" were added to this list by regulation of the State board of health October 6, 1910.

Physician, head of family, etc.—Physicians are required to report cases of the dangerous and contagious diseases in their practice in

writing within 24 hours to the board of health having jurisdiction, giving the name and residence of the sick person. If there is no attending physician it is then the duty of the owner or agent of the building in which the case occurs or of the head of the family to make the report. (Rule XIV, State board of health, 1909.)

Physicians or other persons called to attend cases of smallpox, cholera, plague, yellow fever, diphtheria, membranous croup, scarlet fever, typhoid fever, or any other disease dangerous to the public health, or required by the State board of health to be reported, are required to report said cases to the health officer having jurisdiction, giving the name, age, sex and color of the patient, and the place where the patient may be found. It is also the duty of the head of the family and of the owner or agent of the owner of the building in which cases occur to give immediate notice to the health officer. (Revised Political Code, 1908, sec. 1099.)

Midwives, nurses, etc.—It is the duty of midwives, nurses, or other persons having charge to report within six hours to the local health officer or to some physician when the eyes of an infant under two weeks of age become reddened or swollen or contain pus. (Ibid., sec. 1108.)

Municipal authorities.—All health reports of municipal boards of health must be transmitted to the county board of health quarterly. (Rule IX, State board of health, 1909.)

County authorities.—The county physician is required to make a quarterly report to the State board of health, containing a summary of contagious and infectious diseases. (Rule IV, State board of health, 1909.)

ILLINOIS.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of seven members appointed by the governor. (Rev. Stat., 1909, ch. 126A, sec. 1.)

Counties and townships.—The board of county commissioners in counties not under township organization and the supervisor, assessor, and town clerk of every township in counties under township organization, constitute a board of health with jurisdiction outside of the limits of incorporated cities and villages. These boards have the power to appoint physicians as health officers. (Ibid., ch. 34, sec. 116, 117.)

Cities and villages.—The city council or board of trustees have jurisdiction in and over all places within one-half mile of the city or village limits for the purpose of enforcing health and quarantine ordinances and regulations. (Ibid., ch. 24, sec. 44.)

The city council in cities and the president and board of trustees in villages have the power to appoint a board of health for the respective cities and villages except in cities incorporated under special acts making other provision. (Ibid., ch. 24, sec. 62, par. 76.)

MORBIDITY REPORTS.

Physicians.—The attending physician or the householder in whose dwelling the case occurs must immediately notify the local health authorities of existing cases of smallpox, scarlet fever, diph-

theria, Asiatic cholera, yellow fever, bubonic plague, glanders, anthrax, or leprosy. (Rules and regulations, State board of health, 1907, p. 83.)

Midwives and nurses.—Midwives and nurses having charge of infants under 2 weeks of age are to report in writing within six hours to the local health officer or to some physician whenever the eyes of an infant become inflamed or reddened. (Rev. Stat., 1909, ch. 38, sec. 510.)

Local health authorities.—The local health authorities are required to report immediately to the secretary of the State board of health the first case of smallpox, diphtheria, scarlet fever, Asiatic cholera, yellow fever, bubonic plague, glanders, anthrax, or leprosy occurring in any town, township, village, city, or county, and to report at least once a week the progress of outbreaks of these diseases. (Rules and regulations, State board of health, 1907, p. 83.)

Occupation diseases.—Every employer engaged in carrying on any process of manufacture or labor in which sugar of lead, white lead, lead chromate, litharge, red lead, arsenate of lead, or Paris green are employed, used, or handled, or in the manufacture of brass, or the smelting of lead or zinc, is required, as often as once every calendar month, to cause all employees who come into direct contact with the poisonous agencies or injurious processes to be examined by a competent physician for the purpose of ascertaining if there exists in any employee any industrial or occupational disease or illness, or any disease or illness due or incident to the character of the work in which the employee is engaged. Physicians making these examinations are to immediately report their findings to the State board of health. If any case of such disease is found, the report is to give the name, age, address, and sex of the employee affected, the nature of the disease or illness, and the probable extent and duration thereof, the name of the employer, and the last place of employment. If no case of such disease is found, the report shall so state. The secretary of the State board of health is to immediately forward copies of these reports received by the State board of health to the State department of factory inspection. (Act approved May 26, 1911.)

INDIANA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—There is a State board of health of five members, of whom four are appointed by a board of appointment, consisting of the governor, secretary of State, and auditor of the State. The four so appointed elect a physician to be secretary. The secretary, by virtue of his election, is a member of the State board of health, executive officer of the board, and State health commissioner. (Burns Annotated Indiana Statutes, 1908, ch. 81, sec. 7589, Acts of 1909, ch. 144, sec. 1.)

Counties.—In every county the board of county commissioners elects a physician to be county health commissioner. The State board has the power to discharge any county health commissioner or health officer in the State. (Acts of 1909, ch. 144, secs. 3, 4.)

Cities.—In every incorporated city there is to be a department of health composed of a board of three commissioners, of whom two

must be physicians. This board is to be known as the city board of health and is appointed by the mayor. This board appoints a secretary who is executive officer of the board. (Ibid.)

In counties with a population of less than 30,000 the board of county commissioners may, upon agreement with the mayor or mayors of any or all the incorporated cities within the county, consolidate the boards of health of one city, or the boards of all cities with the office of county health commissioner, and appoint a single health officer known as the county health commissioner. (Ibid.)

Incorporated towns.—The board of town trustees constitutes the board of health and appoints a town health officer. (Ibid.)

MORBIDITY REPORTS.

Notifiable diseases.—The diseases required to be reported immi, diately to the local health officer are yellow fever, smallpox, cholera-diphtheria, membranous croup, scarlet fever, measles, typhus fever, bubonic plague, leprosy, pulmonary consumption, typhoid fever, chickenpox, and whooping cough. (Rule 10, Indiana State Board of Health.)

Physicians.—Physicians and midwives are required to report immediately to the secretary of the local board of health cases of contagious or infectious disease required by the State board of health to be reported. These reports are made on forms supplied by the State board of health. In cities and towns the reports are sent to the city or town health officer. Outside of cities and towns the reports are sent to the county health officer or his deputies. If no physician is in attendance the report is to be made by the householder or person having the case in charge. (Burns Annotated Statutes. 1908, sec. 7607.)

Parents, etc.—Whenever one or both eyes of an infant under 2 weeks of age become inflamed, swollen, or reddened, or show any unnatural discharge, and no legally qualified physician is in attendance, it is the duty of its parents or caretakers to report the fact in writing within six hours to the health officer having jurisdiction. (Acts of 1911, ch. 129, sec. 3.)

Town and city health officers.—Town and city health officers enter the record of cases of infectious disease reported to them in a record book and by the 2d of each month forward the original infectious disease reports received during the preceding month to the county health commissioner. (Rule 6, Indiana State Board of Health.)

County health commissioners.—County health commissioners make a special monthly report to the State board of health by the 8th of each month for the preceding month, giving the number of cases reported of typhoid fever, scarlet fever, smallpox, diphtheria, and membranous croup. They also make quarterly reports of contagious diseases on blanks furnished by the State board. All books and documents are kept at the county seat. (Rule 1, Indiana State Board of Health.)

IOWA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The State board of health consists of the attorney general the State veterinary surgeon, one civil engineer, and seven physicians.

The board elects a secretary, who is not a member of the board. (Iowa Code, Ch. XVI, Title XII.)

Districts.—The State is divided into eight health districts. (Ibid.)

Townships.—The trustees of each township constitute a township board of health and appoint a physician as health officer. (Ibid.)

Cities.—The mayor and council of each town or city constitute a local board of health for the town or city and appoint a physician as health officer. (Ibid.)

MORBIDITY REPORTS.

Notifiable diseases.—Scarlet fever, diphtheria, smallpox, cholera, leprosy, epidemic cerebro-spinal meningitis, poliomyelitis, plague. (Regulations, State board of health, July 21, 1911, Rules I and III.)

Physician or householder.—All cases of the above-named diseases are required to be reported immediately to the mayor of the city or town, or the clerk of the township, if outside of a city or town, by the attending physician, or in his absence, by the householder of the premises wherein the disease exists, this immediate report to be followed within 24 hours by a written notice of the case. (Ibid.)

Midwives, nurses, etc.—Persons in charge of infants are to report to the local health officer or to a physician within six hours whenever the eyes of an infant become inflamed within two weeks after birth. (Acts of 1896, ch. 57, sec. 1. See footnote, p. 123.)

Local authorities.—It is the duty of the mayor of every town and city and the clerk of every township to report to the secretary of the State board of health within 24 hours every case of the above-named diseases reported to him. All reports are to be made on postal cards in accordance with forms adopted by the State board of health.

The mayors of incorporated cities and towns and the clerks of townships are required to keep a record of all cases of contagious or infectious diseases reported to them and to forward a copy of this record for the preceding calendar year to the secretary of the State board of health by the 1st of February. (Regulations, State board of health.)

KANSAS.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—There is a State board of health consisting of nine physicians and one other person ("preferably an attorney") appointed by the governor. The board elects a secretary, who becomes the executive officer of the board, but not a member of it. (General Statutes, 1909, sec. 8027.)

Counties.—The county commissioners of the several counties act as local boards of health for their respective counties, and each board elects a physician, who becomes ex officio a member of the board and health officer of the county. (General Statutes, 1909, sec. 8033.)

MORBIDITY REPORTS.

Physicians.—Whenever a physician knows or has reason to believe that any person whom he is called to visit, or any person sick within

his knowledge without the care of a physician, is sick with or has died of cholera, smallpox, scarlet fever, diphtheria, epidemic cerebro-spinal meningitis, or any disease dangerous to the public health, he is required to give notice of the fact to the nearest board of health or health officer. (General Statutes, 1909, sec. 8074.)

Tuberculosis is declared to be an infectious and communicable disease, dangerous to the public health, and physicians are required to report cases of it to the county health officer, or in cities of the first class (cities having over 15,000 inhabitants) to the city health officer within 24 hours after he becomes aware of their existence, the report to be in writing and to give the name, age, sex, color, occupation, place where last employed, and address. Similar reports are to be made by the chief officer having charge for the time being of any hospital, dispensary, asylum, or other similar private or public institution of cases coming under his observation. (General Statutes, 1909, sec. 8061.)

Householder.—Householders are required to give notice of cases of smallpox, cholera, scarlet fever, diphtheria, epidemic cerebro-spinal meningitis, or any disease dangerous to the public health occurring in their families. (General Statutes, 1909, sec. 8075.)

Local health officers.—Municipal and county boards of health and health officers having knowledge of any contagious or infectious disease, or of a death from such a disease, within their jurisdiction, are required to communicate without delay all information as to existing conditions to the State board of health. (General Statutes, 1909, sec. 8076.)

KENTUCKY.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The State board of health consists of eight physicians, seven appointed by the governor, the eighth member is the secretary and executive officer and is elected by the board, of which he is ex officio a member. (Statutes, 1909, sec. 1757.)

Counties.—The State board of health appoints three physicians in each county, who, together with the county judge and one person elected by the fiscal court of each county, constitute a local board of health for the county. (Ibid., sec. 1743.)

Cities.—It is the duty of the council or board of trustees of every incorporated city and town of more than 2,500 inhabitants to appoint a board of health for such city or town, each of said boards to appoint a physician to be health officer of the city or town and executive officer and ex officio a member of the board. (Ibid., sec. 1769.)

MORBIDITY REPORTS.

Physicians and heads of families.—It is the duty of physicians to report cases in their practice, and of heads of families to report cases in their families, of cholera, smallpox, yellow fever, scarlet fever, diphtheria, and other epidemic and communicable diseases to the county board of health or to some member of the board within 24 hours. (Ibid., sec. 1743.)

County boards of health.—County boards of health are to report at least once in three months to the State board of health the nature and number of cases of the infectious, epidemic, and communicable diseases reported to them. (Ibid., sec. 1743.)

LOUISIANA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of seven physicians appointed by the governor. (Revised Laws, Wolff, 1904, vol. 2, p. 1440.)

Parishes (counties).—The police jury of each parish is required to appoint a parish board of health of three members, of whom one shall be a physician and two shall be members of the police jury, the physician to be the health officer and chairman of the board. (Ibid.)

Cities.—The legislative body of each incorporated municipal government is required to appoint five persons to be members of the town or city board of health. The chairman of the board is health officer. (Ibid.)

For the cities of Shreveport and Baton Rouge, the governor appoints three members and the council two members of the board of health. (Ibid.)

MORBIDITY REPORTS.

Physicians, etc.—Physicians are required to report within 24 hours to the local board of health all cases of contagious disease in their practice, stating the state of the disease, and the patient's place of dwelling and name, if known. (Louisiana Sanitary Code, 1909, Ch. III.)

The phrase "contagious disease" is declared to include diseases of an infectious, contagious, or pestilential nature. (Ibid.)

The following-named diseases are declared to be communicable and dangerous to the public health: Smallpox, cholera, diphtheria, typhoid fever, typhus fever, yellow fever, cerebro-spinal meningitis, relapsing fever, epidemic dysentery, rabies, glanders, charbon, tuberculosis, bubonic plague, leprosy, scarlet fever, measles, pneumonia, dengue.[1] (Ibid.)

Whenever a case of variola or varioloid breaks out in any community of the State, it is the duty of the attending physician, or in the absence of one, of the head of the household, or manager of the hotel, lodging house, or camp where the case may occur, to immediately notify the health officer having jurisdiction, and in the absence of such health officer, to notify the president of the State board of health. (Ibid.)

Physicians are to report cases of consumption in their practice immediately to the municipal or parish health officer on blank forms furnished by the State board of health. (Ibid.)

Cases of pneumonia are to be reported promptly to the local health officer by the attending physician, or in his absence by the head of

[1] The relationship of this list of diseases declared to be communicable, and dangerous to the public health to the preceding declaration that the phrase "contagious disease" shall be held to include diseases of an infectious, contagious, or pestilential nature is not clear.

the household. (Ibid.) Dengue and yellow fever are to be reported promptly by the attending physician. (Ibid, Ch. IX.)

Midwives, nurses, etc.—Persons other than physicians are to report cases of inflamed eyes in newborn children to the town or parish health officer within 12 hours. (Ibid., Ch. III.)

Local health authorities.—The parish health officer is to countersign the reports of cases of consumption received by him and forward them to the State board of health quarterly. (Ibid., Ch. III.)

Municipal and parish health officers are to immediately notify the president of the State board of health of cases of dengue, or yellow fever. (Ibid., Ch. IX.)

The local board of health is to report weekly to the State board, unless otherwise ordered, the progress of any of the quarantinable diseases which may be present in its jurisdiction. (Ibid, Ch. III.)

State board of health.—Whenever a quarantinable disease breaks out in any community of the State, it is the duty of the president of the State board of health to immediately notify the health authorities of surrounding States and the Surgeon General of the Public Health and Marine-Hospital Service. (Ibid., Ch. III.)

MAINE.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—Provision is made for a State board of health consisting of six members appointed by the governor, and a secretary elected by the six members so appointed. The secretary is a member of the board and its executive officer. (Rev. Stat., 1903, ch. 18, sec. 1.

Towns (townships).—The law provides for a board of health of three members appointed by the town (township) authorities in each organized town (township). (Rev. Stat., ch. 18, sec. 24.)

Cities.—Provision is made for a board of health of three members appointed by the municipal authorities in each city. (Ibid.)

MORBIDITY REPORTS.

Physicians and householders.—Householders are required to report cases of the following diseases occurring within their families or households: Smallpox, diphtheria, scarlet fever, cholera, typhus fever, typhoid fever, cerebro-spinal meningitis, measles, membranous croup, and whooping cough. (Poliomyelitis was added January 10, 1911, Regulations State board of health.) Notice is to be given to the health officer of the town either at the office of the health officer or by mail within 24 hours. In the absence of a health officer the report is to be made to the secretary of the local board of health. Physicians are to report cases of the above-named diseases occurring in their practice within 24 hours to the same authority. (Rev. Stat., 1903, ch. 18, secs. 33, 36.)

Physicians are required to report in writing on forms furnished by the State board of health the name, age, sex, color, occupation, place where last employed, and address of every person known by them to have tuberculosis, to the secretary of the State board of health within 48 hours after such fact comes to their knowledge. (Laws 1909, ch. 78, sec. 2.)

Institutions.—It is also the duty of the chief officer having charge for the time being of any hospital, dispensary, asylum, sanatorium, or other similar private or public institution to report in like manner to that prescribed for physicians, every patient having tuberculosis who comes into his care, or under his observation, within 48 hours, and also to state the previous address of the patient and to notify the secretary of the State board of health of changes in address of tuberculous patients who are or have lately been under his care. (Laws 1909, ch. 78, sec. 2.)

Midwives, nurses, etc.—When one or both eyes of an infant under four weeks of age become reddened or inflamed it is the duty of the midwife, nurse, or person having charge to report the fact at once to a legally qualified practitioner of medicine. (Rev. Stat., 1903, ch. 18, sec. 90.)

Local health authorities.—Local boards of health are required to report promptly to the State board of health every case of smallpox, varioloid, diphtheria, scarlet fever, typhoid fever, cerebro-spinal meningitis, measles, membranous croup, whooping cough, and pulmonary tuberculosis occurring within their respective jurisdictions. (Rev. Stat., 1903, ch. 18, sec. 30.)

State.—The State board of health is to keep a register of persons affected with tuberculosis. (Laws 1909, ch. 78, sec. 1.)

MARYLAND.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of seven members, as follows: Four members, of whom one shall be a civil engineer, and three shall be physicians appointed by the governor, the attorney general of the state, and the commissioner of health of the city of Baltimore, the seventh member to be the secretary of the board. (Poe's Public General Laws, 1904, art. 43, p. 1192.) The State board of health and the bureaus under it are designated the State department of health. (Acts of 1910, ch. 560.)

Counties.—The board of county commissioners constitutes a local board of health in each county with jurisdiction throughout the county, except in cites and towns having charters inconsistent with such extension of jurisdiction. Each county board of health is to appoint a physician as county health officer, who thus becomes secretary and executive officer of the board. (Public General Laws, 1904, art. 43, secs. 22, 23.)

MORBIDITY REPORTS.

Physicians.—Physicians are to report immediately in writing to the board of health of the "city, town or county" in which the disease exists, cases of the following-named diseases occurring in their practice: Smallpox, diphtheria, membranous croup, scarlet fever, typhoid fever, typhus fever, yellow fever, measles, whooping cough, and any other contagious or infectious disease dangerous to the public health. (Ibid., sec. 51.)

Physicians are to report cases of pulmonary and laryngeal tuberculosis coming under their care to the secretary of the State board of

health within seven days, upon blanks furnished by said board, the report to give the name, age, sex, color, occupation, social condition, and residence of the person affected. (Ibid., sec. 58.)

Institutions.—The superintendent or other person in charge or control of any hospital, dispensary, school, reformatory, or other institution deriving the whole or any part of its support from the public funds of the State, or of any city, town, or county in the State, having in charge or custody or under care persons suffering with pulmonary or laryngeal tuberculosis is to make, or cause to be made, within 48 hours a record of the name, age, sex, color, occupation, social condition, and residence of the persons affected, these records to be forwarded to the State board of health on Monday of the week immediately following that in which the records are made. (Ibid, sec. 57.)

Householders.—Whenever a householder knows that a person within his family or house is sick with smallpox, diphtheria, membranous croup, scarlet fever, typhoid fever, typhus fever, measles, mumps, whooping cough, or any other infectious or contagious disease dangerous to the public health, he is to immediately give notice of the fact to the board of health of the "city or county" in which he dwells. (Ibid., sec. 50.)

Midwives, nurses, etc.—Midwives, nurses, or other persons in charge of infants under two weeks of age are required to report immediately to the local health officer or to a physician whenever one or both eyes of the infant become reddened or inflamed. (Ibid., art. 27, sec. 231.)

Hotel keepers, etc.—Hotel keepers, keepers of boarding houses and lodging houses, superintendents, managers, or directors of private or public institutions of any kind are to report any cases of known or suspected smallpox, cholera, yellow fever, typhus or typhoid fever, scarlet fever, leprosy, or any other infectious or contagious disease occurring on the premises under their management or control immediately in writing to the health officer of the city or town, or, in the absence of a local health officer, to the secretary of the State board of health. (Ibid., art. 43, sec. 67.)

Local health authorities.—The boards of health of "cities, towns, and counties" are to keep a record of the reports of disease made to them. (Ibid., art. 43, sec. 52.) When any board of health has had notice of the occurrence of a case of smallpox or any other contagious or infectious disease dangerous to the public health it is to notify the State board of health within 24 hours. (Ibid., art. 43, sec. 53.)

State.—The State board of health is to keep a register of all persons in the State known to be affected with tuberculosis. (Ibid., sec. 56.)

Pursuant to the preceding, local boards of health report once a month cases of smallpox, diphtheria, typhoid fever, scarlet fever, measles, whooping cough, mumps, and other diseases. (Secretary State board of health.)

Local health officers are also to promptly notify the secretary of the State board of health of the existence of any epidemic or any unusual sickness or mortality that may come to their knowledge within their respective jurisdictions or contiguous thereto. (Public General Laws, 1904, art. 43, sec. 29.)

MASSACHUSETTS.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—There is a State board of health consisting of seven members appointed by the governor. (Revised Laws, 1902, ch. 75, sec. 1.)

Health districts.—The State board of health was required by an act passed in 1907 to divide the State into not more than 15 districts, to be known as health districts, and to appoint in each district a State inspector of health for the district. The State inspectors of health are under the general supervision of the State board of health. (Acts of 1907, ch. 537, secs. 1, 2, and 4, as amended by Acts 1910, ch. 523.) The State is divided into 14 health districts. (Secretary State board of health.)

Towns (townships).—Each town "may" elect a board of health of three members. If this is not done the selectmen act as a board of health. (Acts of 1907, ch. 560, sec. 366.)

Cities.—In each city except Boston the board of health is to consist of three persons appointed by the mayor, one of whom must be a doctor of medicine, and no one of whom is to be a member of the city council. (Revised Laws, 1902, ch. 75, p. 657.) This does not apply to cities whose charters make other provision for boards or departments of health.

MORBIDITY REPORTS.

Notifiable diseases.—The State board of health is directed to define what diseases shall be deemed to be "dangerous to the public health." (Acts of 1907, ch. 183, sec. 1.)

The State board therefore on August 1, 1907, declared the following diseases to be "dangerous to the public health" and therefore notifiable: Actinomycosis, Asiatic cholera, cerebro-spinal meningitis, diphtheria, glanders, leprosy, malignant pustule, measles, scarlet fever, smallpox, tetanus, trichinosis, tuberculosis, typhoid fever, typhus fever, varicella, whooping cough, yellow fever. Anterior poliomyelitis, ophthalmia neonatorum, and trachoma were added in 1909.

Householders.—A householder who knows that a person in his family or house is sick of smallpox, diphtheria, scarlet fever, or any other infectious or contagious disease declared by the State board of health to be dangerous to the public health is required to forthwith give notice thereof to the board of health of the city or town in which he dwells. (Acts of 1907, ch. 480, sec. 1.)

Nurses.—Whenever one or both eyes of an infant become inflamed, swollen and red, and show an unnatural discharge at any time within two weeks after its birth, it is the duty of the nurse, relative or other attendant having charge of the infant to report the fact in writing within 6 hours thereafter, to the board of health of the city or town in which the parents of the infant reside. (Ibid.)

Physicians.—Physicians are required to give immediate notice of cases of dangerous diseases to the local authorities. If a physician knows that a person whom he is called to visit is infected with smallpox, diphtheria, scarlet fever, or any other disease declared by the State board of health to be dangerous to the public health, or if one or both eyes of an infant whom or whose mother he is called to visit become inflamed, swollen and red, and show an unnatural discharge

within two weeks after the birth of such infant, he is required to immediately give notice of the fact in writing over his signature to the selectmen or board of health of the town. (Ibid, sec. 2.)

Local health authorities.—The boards of health of cities and towns are required to report to the State board of health within 24 hours all cases which are reported to them of the diseases declared by the State board to be dangerous to the public health, and to give the name and location of each patient. (Ibid, sec. 3.)

If a local board of health refuses or neglects to make these reports, the city or town forfeits its claim upon the Commonwealth for the payment of expenses for the care and management of cases of the diseases dangerous to the public health, as provided in section 1, chapter 213, acts of 1902. (Revised Laws, ch. 75, sec. 53.)

MICHIGAN.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—There is a State board of health of seven members appointed by the governor. (Compiled Laws, 1897, sec. 4397, and Laws of 1905, Act 18, sec. 4.)

Townships.—The township board constitutes a board of health. The supervisor is president and the township clerk is clerk of the board. Every board of health appoints a health officer, a physican being appointed where practicable. (Compiled Laws, 1897, sec 4410, 4411.)

Cities and villages.—The mayor and aldermen of each incorporated city, and the president and council or trustees of each incorporated village, in which no board of health is organized under its charter, exercise all the powers and perform all the duties of a board of health within the limits of the city or village. (Ibid., sec. 4459.)

MORBIDITY REPORTS.

Notifiable diseases.—In compliance with section 1, Act 293, Public Acts 1909, authorizing the State board of health to designate what diseases are dangerous, communicable diseases, and what diseases are contagious diseases, and making it the duty of every local board of health and health officer to observe such rules in relation to the dangerous communicable and the contagious diseases as may be prescribed by the State board, the following-named diseases are by regulation declared dangerous, communicable diseases, contagious and infectious in character and dangerous to the public health: Pneumonia, tuberculosis, typhoid fever, meningitis, diphtheria, whooping cough, scarlet fever, measles, and smallpox. Cases of each of these diseases must be reported by the attending physician or householder to the local health officer, who in turn must report them to the State board of health.

The regulation also states that the following-named diseases shall be reported for statistical purposes: Tetanus, rabies, cancer, erysipelas, and leprosy.

Physicians.—Whenever a physician knows that any person whom he is called to visit or who is brought to him for examination, is infected with smallpox, cholera, diphtheria, scarlet fever, or any other disease dangerous to the public health, he is required to imme-

diately give notice thereof to the health officer of the township, city or village, and to the householder, hotel keeper, keeper of a boarding house or tenant within whose house or rooms the sick person may be. The report to the health officer must state the name of the disease and the name, age, and sex of the person sick, and must designate by street and number or otherwise, the house or room in which the person is sick. (Ibid., sec. 4453.)

For this report the physician is entitled to the sum of 10 cents. (Ibid., sec. 4454.)

Every physician attending or called upon to treat a patient whom he believes to be suffering from poisoning from lead, phosphorus, arsenic, or mercury, or their compounds, or from anthrax, or from compressed-air illness, contracted as a result of the nature of the patient's employment, is required to send to the State board of health, who is to transmit to the commissioner of labor, a notice stating the name, post-office address, and place of employment of the patient, the length of time of such employment, and the disease from which in the opinion of the physician the patient is suffering. (Laws of 1911, act 119, sec. 1.)

Householders, etc.—Whenever any householder, hotel keeper, keeper of a boarding house or tenant knows or is informed by a physician or has reason to believe that any person in his family, hotel, boarding house, or premises is taken sick with smallpox, cholera, diphtheria, scarlet fever, or any other disease dangerous to the public health, he is required to immediately report the case to the local health officer. (Ibid., sec. 4452.)

Midwives, nurses, etc.—Midwives, nurses, or other persons in charge of infants are required to report in writing within six hours after its discovery to the local health officer or some legally qualified practitioner of medicine whenever one or both eyes of an infant become inflamed or swollen or reddened, or whenever any pus or secretion forms in the eyes or upon the edge of the lids at any time within two weeks after birth. (Ibid., sec. 4475.)

Tuberculosis.—Tuberculosis is declared to be an infectious and communicable disease. Physicians are required to report to the local health officer within 24 hours, in writing, the name, nationality, age, sex, color, occupation, place where last employed, and address of every person known by the physician to have tuberculosis, also the occupation at the time the disease was contracted and the date thereof, as near as can be, the time thereafter continued at such occupation, and all subsequent occupations and the term of each up to the time of death or recovery of the patient. It is also made the duty of the chief officer having charge for the time being of any hospital, dispensary, asylum, or other similar private or public institution to report in like manner, and in addition give the previous address of the cases of tuberculosis coming into his care or under his observation. (Laws of 1909, Act 27, secs. 1 and 12a, as amended by Act 317; Laws of 1909, and Act 80, Laws of 1911.)

It is the duty of the attending physician to report to the local health officer whenever a person having tuberculosis recovers therefrom. (Ibid., sec. 12.)

It is the duty of local health officers to record all reports of cases of tuberculosis, including the results of examinations showing the

presence of tubercle bacilli, in a register furnished by the State board of health and to forward to the State board of health a copy of this register quarterly. The registers are not open for inspection except to the health authorities. (Ibid., sec. 4.)

The State board of health shall, when it receives the full quarterly report, compile such report to show the number of cases and the location of each case, the number of deaths and the number of recoveries, the age, sex, and color, and the occupation at the time the person contracted the disease, and all subsequent occupations and the term of each up to death or recovery, and shall classify them to show the percentage of deaths in each trade or occupation from tuberculosis, these compilations to be published annually in the reports of the State board. (Ibid., sec. 12a.)

Local health officers.—Whenever the health officer of any township city, or village, receives notice or otherwise has good reason to believe that there is in his jurisdiction a case of smallpox, diphtheria, scarlet fever, or other communicable disease dangerous to the public health, it is his duty to keep the secretary of the State board of health constantly informed respecting the outbreak. (Compiled Laws, 1897, sec. 4460.)

MINNESOTA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The State board of health consists of nine members appointed by the governor. The board elects a secretary who is the executive officer of the board and may or may not be one of its members. The board exercises general supervision over all health officers and boards. (Revised Laws, 1905, sec. 2127–2130.)

Counties.—The county board elects two of its members and a resident physician to constitute a board of health for each county with jurisdiction over all unorganized towns therein. At least one member of every local board must be a physician and act as local health officer and executive of the board. (Ibid., sec. 2134.)

Townships.—Every township board of supervisors constitutes a board of health for the township, and has jurisdiction over every village within its boundaries in which no organized board of health exists. The board of supervisors must appoint a physician to act as health officer. (Ibid., sec. 2134.)

Cities and villages.—Villages may and cities must provide by ordinance for the establishment of a board of health. In the absence of such provision in any city, the State board may appoint three persons to act as a board. One member of every local board must be a physician and act as health officer. (Ibid., sec. 2134.)

MORBIDITY REPORTS.

Physicians.—Physicians are to report immediately to the local health officer cases of the following diseases coming under their care: Smallpox, epidemic cerebro-spinal meningitis, epidemic anterior poliomyelitis, scarlet fever, diphtheria, measles. (Regulations, Minnesota State Board of Health, June 15, 1910.)

Cases of tuberculosis and typhoid fever are to be reported to the State board of health on blanks furnished for the purpose, within

one week after the patient comes under treatment, except that in cities and villages where physicians are required by ordinance or regulation to report such cases to the local board of health they are not required to also report them directly to the State board of health provided the local health officer makes returns of all such cases reported to him to the State board of health once a month on blanks furnished for the purpose. (Ibid.)

Midwives, nurses, etc.—Persons in charge of infants under 2 months of age are to report to the local health officer in writing within 12 hours whenever the eyes of such infant become inflamed. (Ibid.)

Local health officer.—Local health officers are to report immediately to the secretary of the State board of health cases of the following-named diseases occurring within their respective jurisdictions: Smallpox, scarlet fever, diphtheria, epidemic cerebro-spinal meningitis, anterior poliomyelitis, measles, typhoid fever and tuberculosis. (Ibid.)

MISSISSIPPI.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—Department of public health: The Mississippi State Medical Association, and all other State, district, and county medical societies and associations of the State in affiliation with the purposes of its organization are constituted the Mississippi Department of Public Health. Any licensed practitioner of medicine may on application have his name enrolled as a member of said department. (Mississippi Code, 1906, sec. 1640.)

Board of health.—The State board of health consists of 13 physicians appointed by the governor. (Ibid, sec. 2482.) The board elects a president and a secretary from its members. (Ibid., sec. 2484.) It may remove county health officers from office. (Ibid., sec. 2490.)

Counties.—It is the duty of the bureau of vital statistics of the State department to appoint a county board of health in each county, consisting of one physician from each supervisor's district, for the purpose of collecting vital, mortuary, and sanitary statistics. The county health officer is chairman of the board. The county board "may" keep books of register for births, deaths and infectious disease. (Ibid., sec. 1645.)

The State board of health appoints in each county a physician to be county health officer. If interior counties do not want a health officer, the State board of health need not appoint one. (Ibid., sec. 2491.)

Cities.—Any municipality "may" establish a board of health and pass sanitary laws not inconsistent with the rules and regulations of the State board of health. (Ibid., sec. 2505.)

MORBIDITY REPORTS.

Physicians.—Physicians are required to report immediately to the secretary of the State board of health every case of yellow fever, cholera, dengue, smallpox, or other virulent, epidemic, contagious disease occurring in their practice, unless the State board of health directs otherwise. (Ibid., sec. 2498.) Physicians are also to report to the secretary of the State board of health all cases of tuberculosis,

consumption, or other pulmonary diseases in their practice within 10 days. (Acts of 1910, ch. 130, sec. 1.)

MISSOURI.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The State board of health consists of seven members, appointed by the governor. At least five of the members are required to be physicians. (Annotated Statutes 1906, secs. 7518, 7519.)

Counties.—There is a county board of health in each county, consisting of the judges of the county court, and a physician appointed by them. This board has jurisdiction outside of incorporated cities and towns. The county boards are subsidiary to the State board. (Ibid., sec. 7529A.)

Cities.—St. Louis: Provision is made for a health department controlled by a board of health and a health commissioner. The health commissioner is appointed by the mayor. The board of health consists of the mayor, the presiding officer of the council, a commissioner of police, the health commissioner, and two physicians. (City charter, Art. XII.)

Cities of the first class (population between 75,000 and 150,000): Provision is made for a health department in all cities of the first class, this department to be under the control of a board of health consisting of the mayor and three members appointed by him. One member, but not more than one member, of the board must be a medical practitioner. (Laws, 1909, secs. 291, 292.)

MORBIDITY REPORTS.

County health officer.—It is the duty of the county health officer to immediately report to the secretary of the State board of health cases of the following-named diseases, whenever they occur within his jurisdiction: Smallpox, diphtheria, membranous croup, scarlet fever, typhus fever, yellow fever, cholera, bubonic plague, and leprosy. (Regulations, State board of health, Rules I and II.)

It is the duty of the secretary of the county board of health to report quarterly to the secretary of the State board of health, "the number of contagious diseases and the results during the past quarter." These reports are to be made on the 1st of March, June, September, and December, and are to conform to the blanks furnished by the secretary of the State board of health. (Ibid, Rule 12.)

MONTANA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The governor appoints three physicians who, together with the governor, attorney general, and State veterinarian, constitute the State board of health. The board elects a physician as secretary, who becomes a member of the board, its executive officer, and the State health officer. (Revised Codes, 1907, sec. 1474.)

Counties.—The board of county commissioners and one physician whom they appoint, constitute the county board of health. The

physician so appointed becomes secretary of the board, and county health officer. (Ibid., sec. 1492.)

Cities and towns.—The municipal authorities of each incorporated city and town appoint a board of health of three members, one of whom must be a physician; except that incorporated towns of less than 5,000 inhabitants may place themselves under the care of the county board of health, in which case the jurisdiction of the county health officer includes the town. (Ibid., sec. 1484.)

MORBIDITY REPORTS.

Notifiable diseases.—The communicable diseases are designated as smallpox, diphtheria, scarlet fever, cholera, plague, yellow fever, "spotted" or "tick" fever, typhus fever, typhoid fever, cerebrospinal meningitis, and measles. (Ibid., sec. 1500.)

Householders.—Householders are required to report immediately to the health officer of the town or city or county in which they reside cases of any of the communicable diseases within their families or households. (Ibid., sec. 1501.)

Physicians.—Physicians are required to report cases of the communicable diseases in their practice immediately to the health officer of the city or town, or if not in a city or town, then to the county health officer. (Ibid., sec. 1502.)

Local health officers.—Local and county health officers are required, on or before the 5th day of each month, to forward to the secretary of the State board of health, on blanks provided for the purpose, a report of all communicable diseases reported to them during the preceding calendar month. (Ibid., sec. 1495.)

NEBRASKA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The State board of health consists of the governor, the attorney general, and the superintendent of public instruction. The governor appoints four physicians to be secretaries. (Compiled Statutes, 1909, secs. 4315, 4317.)

Counties.—The law provides that the county board of supervisors or commissioners in each county shall establish a board of health, one member of which shall be a physician, the board of health to have jurisdiction throughout the county except in cities and villages having power to establish boards of health. (Ibid., sec. 4401.)

Cities.—Cities of over 100,000 population have a health commissioner. Cities of less than 100,000 population have power to create a board of health. (Ibid., secs. 894, 1246.)

MORBIDITY REPORTS.

Physicians.—Physicians residing or practicing within the limits of any city, town, or township are required to report to the local board of health within 24 hours by the most expedient method cases of Asiatic cholera, yellow fever, smallpox (or varioloid), diphtheria (membranous croup), scarlet fever (scarlet rash or scarlatina), measles, typhus fever, ophthalmia neonatorum, typhoid fever, cerebro-spinal

meningitis, leprosy, whooping cough, chicken-pox, tuberculosis, puerperal fever, or any other disease contagious or dangerous to public health. Where no physician is in attendance the responsibility for reporting the case falls upon any person having charge, or the head of the family, or any person having the care or custody of any lodging rooms in which cases occur. School teachers are also to report to the local board of health cases of the above-named diseases. Where no local board of health is organized all the reports provided for above are to be made to the State board of health. (Rule 1, Regulations State board of health, promulgated in compliance with sec. 6, art. 7, ch. 55, Rev. Stat., 1903.)

Local boards.—Local boards of health are required during the prevalence of any of the diseases named in the preceding paragraph to make adequate report from time to time to the State board of health, giving the nature of the diseases and the number of cases. (Ibid., Rule 3.)

It is the duty of all boards of health to report to the State board of health promptly the existence of any one of the following diseases: Asiatic cholera, yellow fever, smallpox, scarlet fever, diphtheria, typhus fever, typhoid fever, and such other contagious and infectious diseases as the State board of health may from time to time specify. (Compiled Statutes, 1909, ch. 55, § 4404, sec. 8.)

NEVADA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The State board of health consists of a president and a secretary appointed by the governor and a third member appointed by the governor and the president and secretary of the board. (Laws of 1911, ch. 199, sec. 1.)

Counties.—In each county there is a board of health consisting of the county physician, the sheriff, and the board of county commissioners. The county physician acts as chairman of the board. (Laws of 1905, ch. 42, sec. 1.)

Cities.—In incorporated cities and towns the city council has the power to create a board of health and prescribe its powers and duties. (Laws of 1907, Ch. CXXV.)

The boards of county commissioners have the power to establish and maintain a board of health in any town or city in their respective counties. (Laws of 1903, Ch. XXXVIII.)

MORBIDITY REPORTS.

There is no State law requiring the reporting of cases of sickness.

NEW HAMPSHIRE.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The State board of health consists of the governor, the attorney general, three physicians, and a civil engineer, the last four named being appointed by the governor. The board appoints a physician as secretary and executive officer of the board. The secre-

tary may be a member of the board. (Public Statutes, 1891, ch. 107, secs. 1, 2.)

Towns (townships).—The selectmen of each town are required to appoint a board of health, consisting of three persons, of whom at least one shall, whenever practicable, be a physician in active practice in the town. (Acts of 1897, ch. 45, sec. 1 as amended by sec. 1, ch. 65, Laws of 1899.)

Cities.—All powers vested in the board of health of towns is in cities vested in the city council. (Public Statutes, 1891, ch. 50, sec. 9.)

MORBIDITY REPORTS.

Physicians.—It is the duty of every physician who attends upon any person infected with smallpox, malignant cholera, diphtheria, scarlet fever, or other malignant pestilential disease to immediately report the same to the health officers, or, in their absence, to the selectmen of the town. (Acts of 1901, ch. 13, sec. 1.) Similar report is to be made in the event of suspected cases of smallpox. (Acts of 1903, ch. 45, sec. 1.)

It is also the duty of every physician practicing medicine or surgery to report in writing to the State board of health, within one week after the disease is recognized, on forms provided by said board, the name, age, sex, color, occupation, and address of every person under his care who in his opinion is infected with pulmonary or other form of tuberculosis. It is also the duty of the officer having charge for the time being of each and every hospital, dispensary, asylum, or other public or private institution, to report in like manner, the name, age, sex, color, occupation, and last address of every person in his care or who has come under his observation, within one week of such time, who in his opinion is infected with pulmonary or other form of tuberculosis. Physicians are also to report the recovery of cases of tuberculosis to the State board of health. (Acts of 1911, ch. 6, secs. 1 and 5.)

Householders and others.—Whenever any person knows, or has reason to believe, that any member of his family or household (boarder, roomer, or visitor) has either smallpox, diphtheria, membranous croup, scarlet fever, typhoid fever, measles, or any other malignant communicable disease, he is required to give notice within 24 hours, if no physician is in attendance, to the local board of health of the town or city in which he resides. Such notice may be given either verbally or in writing. (Acts of 1901, ch. 16, sec. 2.)

Upon the appearance of smallpox, typhoid fever, or any other dangerous, communicable disease in any unincorporated locality in the State, it is made the duty of any person having knowledge thereof immediately to notify the State board of health of the appearance of such disease, provided there is no local board of health having jurisdiction in the locality. (Acts of 1911, ch. 17, sec. 1.)

Local board of health.—Upon the appearance of any of the diseases named in the preceding paragraph in any town or city, the board of health is required to make an immediate report to the State board of health, upon blanks furnished for the purpose, and to thereafter make a weekly report as long as the dise se continues, stating the number of cases, the number of infected houses, the fatality, and such other facts as may be required by the State board. (Ibid., sec. 5.)

State board of health.—The State board of health is required to keep a register of all cases in which the tubercle bacilli has been found present. This register is not to be open to inspection in such manner as to reveal the identity of the patient, except to a health officer. The recovery of cases is also to be recorded in the register. (Acts of 1911, ch. 6, sec. 3-5.)

NEW JERSEY.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—Provision is made for a State board of health composed of six persons appointed by the governor, one of whom must be a physician, and becomes secretary of the board. (Act approved Mar. 31, 1887, sec. 1 as amended by sec. 1, ch. 299, Laws of 1908.)

Townships.—In each township the township committee, the township assessor, and one physician appointed by the township committee constitute a board of health for the township. (Laws of 1887, ch. 68, sec. 10.)

Cities.—Every city, borough, and town is required to have a local board of health. (Ibid., sec. 9.)

MORBIDITY REPORTS.

Physicians, etc.—Every physician is required to report within 12 hours to the local board of health having jurisdiction, or in the absence of such board to the assessor of the township, all cases of the following named diseases occurring in his practice: Cholera, yellow fever, typhus fever, leprosy, plague, trichinosis, smallpox, varioloid, typhoid fever, diphtheria, membranous croup, scarlet fever, malaria, tuberculosis in any of its manifestations, trachoma, rabies, glanders, anthrax, chickenpox, poliomyelitis, or any other contagious, infectious, or communicable disease which the State board of health may declare to be preventable and specially dangerous to the public health. The report is to be in writing, signed by the physician, and to include the name, age, and location of the person suffering from the disease. (Acts of 1911, ch. 381, sec. 1.)

When no physician is in attendance, the case is to be reported within 12 hours by the house owner or householder in whose dwelling or building it occurs. (Ibid.)

Physicians are to report in writing to the local board of health of the city, borough, town, or other municipality the name, age, sex, color, occupation, place where last employed, if known, and address of every person known by them to have tuberculosis. The report is to be signed and is to be made within 48 hours after the fact comes to the knowledge of the physician. Similar reports including the previous address are to be made within 48 hours by the chief officer having charge for the time being of any hospital, asylum, prison, or other private or public institution, of every patient having tuberculosis who comes under his care or observation. (Acts of 1910, ch. 169, sec. 1.)

Every physician who attends any person sick with typhoid fever, dysentery, scarlet fever, diphtheria, or tuberculosis on any dairy premises where milk is produced for sale or distribution, or in a household any member of which is employed at such a dairy, is

required to report the case within 12 hours after his first attendance, to the State board of health, giving the nature of the disease, the name of the person sick, and his place of residence. (Acts of 1911, ch. 380, secs. 1-2.)

Midwives, nurses, etc.—Ophthalmia neonatorum: When one or both eyes of an infant become inflamed, swollen, or reddened, or show any unnatural discharge at any time within two weeks after birth and no legally qualified practitioner of medicine is in attendance upon the infant at the time, it is the duty of the midwife, nurse, attendant, or relative having charge of the infant, to report the case in writing to the local board of health of the city, township, or other municipality within six hours. (Acts of 1895, Ch. CXVIII, sec. 1; also General Statutes, 1895, p. 1676, sec. 1.)

Local health authorities.—Reports of disease made by physicians in pursuance to section 1, chapter 381, Acts of 1911, cited above, are to be entered in a book kept for the purpose by the officer receiving them. This officer is also required to transmit by mail to the State board of health a transcript of the reports received by him at least once a week, and daily when required by the State board. (Acts of 1911, ch. 381, sec. 2.)

NEW MEXICO.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

Territory.—Provision is made for a board known as the New Mexico Board of Health and Medical Examiners, and composed of seven physicians appointed by the governor. This board elects one of its members secretary. (Acts of 1907, ch. 34, sec. 1, as amended by ch. 99, Acts of 1909.)

Counties.—The board of county commissioners in each county annually contracts in writing with some reputable physician to be county health officer. The health officer so appointed is subject to the orders of the board of county commissioners, and may with the board's consent appoint as many assistant health officers as the public health and safety require. (Acts of 1909, ch. 99, sec. 4.)

Cities.—The mayor and council, trustees or other governing bodies of incorporated cities and towns constitute a board of health for the city or town. (Laws of 1901, Ch. XVII, sec. 25.)

MORBIDITY REPORTS.

Physicians.—Whenever any physician or other person knows that any person is sick with smallpox or other contagious or infectious disease, dangerous to the public health, he is required to at once give notice thereof to the justice of the peace of the precinct in which the disease occurs if outside of an incorporated city, town, or village; if within the limits of a city, town, or village, then the notice is to be given to the health officer of the county. Whenever such notice is given to any justice of the peace, it is his duty to at once notify the health officer of the county. (Acts of 1903, ch. 103, sec. 19.)

Householders.—Whenever any householder knows that any person in his family is sick with smallpox or other contagious disease, dangerous to the public health, he is required to immediately give the same notice thereof as is required of physicians. (Ibid., sec. 20.)

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—Provision is made for a State department of health at the head of which is a commissioner of health, appointed by the governor. The commissioner must be a physician. (Consolidated Laws, 1909, p. 4422, sec. 2.)

In the State department of health there is a bureau of vital statistics for the registration of births, marriages, deaths, and prevalent diseases. (Ibid., p. 4423, sec. 5.)

If any municipal corporation (town, city, or village) authorized by law to establish a local board of health, omits to do so, the State commissioner may, in such municipality, exercise the powers of a local board of health and appoint a health officer for the corporation, and fix his duties and compensation. (Ibid., p. 4426, sec. 11.)

Towns (townships).—The town (township) board and one other citizen appointed by the town board constitute a town board of health, and appoint a physician to be town health officer. (Ibid., p. 4428, sec. 20.)

A town board of health does not have jurisdiction over any city or incorporated village, or part of such city or village within the town, provided such city or village has an organized board of health. (Ibid., p. 4445, sec. 34.)

Cities of the first class (cities having a population of over 175,000).—The charters of cities of the first class provide for the appointment of a commissioner of health by the mayor.

Cities of the second class (cities with a population of between 50,000 and 175,000).—In cities of the second class the commissioner of public safety (appointed by the mayor) exercises all the powers and performs the functions of a local board of health. He appoints a physician to be health officer. (Consolidated Laws, 1909, p. 5318, secs. 130, 131; and p. 5324, secs. 145, 146.)

Cities of the third class (cities with a population of less than 50,000).—In cities of this class there is a board of health consisting of the mayor and at least six other persons, one of whom must be a physician, nominated by the mayor, and appointed by the common council. This board, unless the city charter provides otherwise, appoints a physician to be health officer of the city. (Ibid., p. 4428, sec. 20.)

Villages.—In villages the board of trustees appoints a board of health of not less than three persons, nor more than seven. This board appoints a physician to be health officer. (Ibid.)

MORBIDITY REPORTS.

Notifiable diseases.—The following named diseases are those designated by the State department of health to be reported: Anterior poliomyelitis, anthrax, bubonic plague, cancer, cerebro-spinal meningitis, cholera, diphtheria, hydrophobia, leprosy, measles, ophthalmia neonatorum, pellagra, pneumonia, scarlet fever, smallpox, tetanus, pulmonary or laryngeal tuberculosis, typhoid fever, typhus fever, whooping cough, yellow fever. (Monthly Bulletin, New York State Department of Health, November, 1910, p. 299.) (*See also* p. 156.)

Physicians, etc.—Every physician is required to immediately give notice of every case of infectious and contagious or communicable disease, required by the State department of health to be reported to it, to the health officer of the city, town (township), or village in which the case occurs. When no physician is in attendance on the case, it is the duty of the superintendent or other officer of an institution, hospital, or hotel or lodging-house keeper, or other person where the case occurs, to give such notice. The physician or other person giving the notice is entitled to the sum of 25 cents therefor. (Consolidated Laws, 1909, p. 4436, sec. 25.) (*See also* p. 156.)

Tuberculosis is declared to be an infectious and communicable disease, dangerous to the public health, and it is made the duty of every physician to report in writing the name, age, sex, color, occupation, place where last employed if known, and address of every person known by such physician to have tuberculosis, this report to be made to the health officer of the city, town (township), or village in which the case occurs within 24 hours after the fact comes to the knowledge of the physician. (Ibid., p. 4544, sec. 320.)

It is also the duty of the chief officer having charge for the time being of any hospital, dispensary, asylum, or other similar public or private institution, to report in like manner the name, age, sex, color, occupation, place where last employed if known, and previous address of every person having tuberculosis who comes into his care, or under his observation, this report to be made within 24 hours. (Ibid., p. 4544, sec. 320.)

Upon the recovery of any person having tuberculosis it is the duty of the attending physician to make a report of the fact to the local health officer. (Ibid., sec. 330.)

Local health authorities.—Local boards of health are required to report to the State department of health promptly the facts relating to infectious, contagious, or communicable diseases, and every case of smallpox or varioloid within the municipality (city, village, or town). Health officers of cities, villages, and towns (townships) are to report in writing once a month to the State department of health all cases of such infectious and contagious or communicable disease as may be required by the State department of health. Health officers of villages and towns are to be paid by the municipalities employing them a sum not to exceed 20 cents for each case so reported. (Ibid., p. 4436, sec. 25.)

The health officers, commissioners of health, or boards of health of cities of the first class, are required to report promptly to the State department of health all cases of smallpox, typhus fever, yellow fever, and cholera. and the facts relating thereto. (Ibid., p. 4436, sec. 25.)

NORTH CAROLINA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The State board of health consists of five persons (one of whom is a sanitary engineer) appointed by the governor, and four members of the Medical Society of the State of North Carolina chosen by the medical society by ballot. The board of health elects a secretary-treasurer who is known as the State health officer. (Revisal of 1905, secs. 4435, 4440.)

Counties.—There are county boards of health consisting of the chairman of the board of county commissioners, the mayor of the county town (in the absence of a mayor the clerk of the superior court), the county superintendent of schools, and two physicians chosen by the three first named. These boards elect in each county a county superintendent of health. The chairman of the board of county commissioners appoints as county quarantine officer a candidate approved by the State board of health. (Acts of 1911, ch. 62, secs. 9, 16.)

Townships.—The county quarantine officer is empowered to appoint one deputy quarantine officer in each township of the county. (Ibid., sec. 19.)

Cities.—City and town authorities are authorized to elect municipal health officers. (Ibid., sec. 14.) The city or town authorities may assign the duties of the quarantine officer in the city or town to the municipal health officer. (Ibid., sec. 15.)

MORBIDITY REPORTS.

Notifiable diseases.—Smallpox, diphtheria, scarlet fever, measles, whooping cough, yellow fever, typhus fever, cholera, and bubonic plague. (Ibid., secs. 17, 18.)

Physicians.—If a physician suspects that a person whom he is called to visit is infected with any one of the above-named diseases he is required to immediately give notice to the quarantine officer, or the deputy quarantine officer. (Ibid., sec. 18.)

Householders.—If a householder knows that a person within his family is sick with any one of the above-named diseases he is to give immediate notice to the quarantine or deputy quarantine officer. (Ibid., sec. 17.)

Deputy quarantine officers (townships).—The deputy quarantine officer is required to at once notify the county quarantine officer whenever he receives notice of the existence of cases of any of the notifiable diseases. (Ibid., sec. 19.)

Quarantine officers (counties and cities).—The quarantine officer is to notify the secretary of the State board of health by telegram within 24 hours after receiving information of the presence of yellow fever, cholera, typhus fever, or bubonic plague, of the existence of every case. He is also to mail to the secretary of the State board of health not later than the 5th of each month the original records of all cases of the notifiable diseases for the preceding month. (Ibid., sec. 19.)

NORTH DAKOKA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The State board of health consists of a president, a vice president, and a superintendent of health appointed by the governor. The State board of health superintends the several city, village, and county boards of health. (Revised Code, 1905, secs. 252, 255.)

Counties.—Provision is made for county boards of health composed of a president, a vice president, and a county superintendent of health appointed by the board of county commissioners. The county boards of health have jurisdiction within their respective counties, outside of the corporate limits of cities having a city board of health, and

subject to the supervisory control of the State board of health and the superintendent of public health. (Ibid., secs. 259, 262.)

Townships.—The supervisors of each township constitute a board of health for the township. (Ibid., sec. 3116.)

Cities.—In each incorporated city there is a board of health, and the mayor appoints a physician to be health officer. (Ibid., secs. 266, 267.)

The trustees of each incorporated village constitute a board of health for the village. (Ibid., sec. 3116.)

MORBIDITY REPORTS.

Physicians, etc.—Any physician attending a case of infectious or contagious disease is required by law to immediately notify the health officer within whose jurisdiction the case occurs, giving the name of the patient, place of residence, and character of the disease, and in addition to certify the facts to the clerk of the civil township in which the disease occurs, and in counties not organized into civil townships, to the county commissioner having jurisdiction. (Revised Code, 1905, sec. 290.)

The law also provides that whenever it comes to the knowledge of any physician or other person that a contagious, epidemic, or infectious disease exists within the jurisdiction of any local board, he shall immediately report to such board in writing the name and place of residence, if known, of every person afflicted with such disease, and if he is the attending physician of such person, he shall report not less than twice in each week the condition of each person so afflicted and the state of the disease. (Ibid., sec. 275.)

Each keeper of any private house, boarding house, lodging house, inn, or hotel is required to report in writing to the local board of health within whose jurisdiction the case may occur each case of contagious, infectious, or epidemic disease which may occur in his house, inn, or hotel, such report to be made within 24 hours after the existence of the disease becomes known, and to show the name of the patient and the nature of the disease. (Ibid., sec. 277.)

Also when no physician is employed, it is the duty of the parents to give, within 24 hours, notice to the proper office of the presence of contagious or infectious disease within their household. (Ibid., sec. 289.)

Also the oldest person next of kin, the keeper or other proper officer of every workhouse, poorhouse, reform school, jail, prison, hospital, asylum, or other public or charitable institution is to give like notice of any infectious or contagious disease occurring among the persons under his charge. (Ibid., sec. 289.)

Whenever one or both eyes of an infant become inflamed, swollen, or reddened, or show any unnatural discharge, or secretion at any time within two weeks after its birth, and no legally qualified physician is in attendance upon the infant at that time, it is the duty of its parents, or in their absence, whoever is caring for said infant, to report the fact in writing within six hours after discovery, to the health officer having jurisdiction. This report is not required to be made from recognized hospitals. (Acts of 1911, ch. 188, sec. 3.)

Local health authorities.—The health officer of each city, the clerk of each civil township, and in counties not organized into civil town-

ships the county commissioner for his district, and the superintendent of the county board of health of each county are required to obtain and register in the registry of infectious and contagious diseases the names of the persons affected; the sex, color, and age of such persons; the nature of the disease; and the date of record. (Ibid., sec. 288.)

It is the duty of the health officer of each city and the clerk of each organized civil township, and in counties not organized into civil townships the county commissioner for his district, to make and send a certified copy of the registry of infectious and contagious diseases for the preceding month to the superintendent of the county board of health, not later than the 10th of each month. (Ibid., sec. 291.)

It is the duty of each local board of health, whenever it comes to its knowledge that a case of smallpox, scarlet fever, diphtheria, or other infectious or contagious disease exists within its jurisdiction, to immediately notify the State board of health of the existence and nature of such disease. (Ibid., sec. 282.)

County boards of health.—The superintendent of the county board of health of each county is to make and send to the State superintendent of health, on or before the 15th day of each month, a copy of the records showing all the cases of infectious or contagious diseases reported to him for the preceding month. (Ibid., sec. 292.)

The county superintendent of health is to report the facts immediately to the superintendent of public health (State) whenever any contagious or infectious disease occurs in his county, either among persons or animals. (Ibid., sec. 260.)

State authorities.—The superintendent of public health is to make to the governor on the 1st day of December of each even-numbered year a full report showing the character and extent during the preceding two years of all contagious or infectious diseases which have been reported to him. (Ibid., 1905, sec. 257.)

OHIO.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—Ohio has a State board of health consisting of eight members. The attorney general is ex officio member of the board. The other seven members are appointed by the governor. (Ohio General Code, 1910, sec. 1232.) The board elects a secretary. (Ibid., sec. 1234.)

Townships.—The trustees of the township constitute a board of health for the township outside the limits of cities and villages. They appoint a health officer. (Ibid., sec. 3391.)

Cities and villages.—The law specifies that the council of each city and village shall establish a board of health of five members appointed by the mayor. (Ibid., sec. 4404.) The board of health appoints a health officer. (Ibid., sec. 4408.)

In villages the council may appoint a health officer instead of a board of health, such appointee to be approved by the State board of health. (Ibid., sec. 4404.) If any city, village, or township fails or refuses to establish a board of health, or appoint a health officer, the State board of health may appoint a health officer for such city, village (ibid., sec. 4405), or township (ibid., sec. 3393).

MORBIDITY REPORTS.

Notifiable diseases.—Smallpox, cholera, plague, yellow fever, typhus fever, diphtheria, membranous croup, scarlet fever, typhoid fever, and any other disease dangerous to the public health, or required by the State board of health to be reported. (Ibid., sec. 4427.)

The State board of health requires reports also of cases of cerebrospinal meningitis, chickenpox, measles, whooping cough (Sept., 1910), infantile paralysis (Dec., 1910), and trachoma (Mar. 2, 1911).

Physicians.—Physicians or other persons attending cases of the above-named diseases, owners or agents of buildings in which cases reside, and heads of families in which cases exist are required to report the cases to the health officer within whose jurisdiction they occur, giving in such report the name, age, sex, and color of the patient and the house or place in which he may be found. (General Code, sec. 4427.)

Midwives, nurses, etc.—Midwives, nurses, or relatives in charge of infants less than 10 days old are to report within six hours in writing to the physician in attendance or to the local health officer whenever such infant's eyes become inflamed or swollen or show an unnatural discharge. (Ibid., sec. 12787.)

Boards of health.—Health authorities or officials, and physicians in localities where there are no health authorities or officials, are required to report promptly to the State board of health the existence of cases of Asiatic cholera, yellow fever, smallpox, scarlet fever, diphtheria, membranous croup, typhus or typhoid fever, and such other contagious or infectious diseases as the State board may specify. (Ibid., sec. 1243.)

The State board requires the boards of health of cities, villages, and townships to make semimonthly, on the 1st and 16th of each month, a report of the recorded cases of the following-named diseases: Asiatic cholera, bubonic plague, cerebro-spinal meningitis, chickenpox, diphtheria, measles, membranous croup, scarlet fever, smallpox, typhoid fever, typhus fever, whooping cough, and infantile paralysis. (Sept., 1910.)

OKLAHOMA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—Oklahoma has a State board of health in charge of one commissioner, known as the State commissioner of health, who is appointed by the governor and has power to make and enforce any and all needful rules and regulations for the prevention and cure and to prevent the spread of any contagious, infectious, or malarial disease among persons, and to superintend the several boards of health in the counties, cities, villages, towns, and townships. (Laws 1907–8, ch. 79, secs. 1, 2.)

Counties.—The law requires that the State commissioner of health shall appoint in every county of the State a county superintendent of public health, who shall be a practicing physician in good standing and a resident of the county. (Ibid., sec. 6.)

Townships.—In each township of each county the board of directors constitutes a township board of health, and in its capacity as such is under the supervision of the county superintendent of public

health, and is governed by rules and regulations prescribed by the State board of health. It is the duty of the township board to enforce, under the direction of the county superintendent of public health, rules and regulations of the State board pertaining to quarantine or contagious and infectious disease. (Ibid., sec. 7.)

Cities.—Incorporated towns (villages): The town board of directors constitutes a board of health and performs the same duties as the township board, and is under the same supervision of the county superintendent and the State board. (Ibid., sec. 8.)

Cities of the first class: In cities of the first class the mayor and common council constitute a board of health and are authorized to appoint a city superintendent of public health, who shall be a practicing physician and a resident of the city. It is the duty of the mayor and council to enforce all rules and regulations in regard to the public health. (Ibid., sec. 9.)

(All cities of over 2,000 population may become cities of the first class.)

MORBIDITY REPORTS.

Physicians.—Practicing physicians are required to report to the county superintendent of public health, upon forms prescribed and furnished by the State board of health, all cases of infectious and contagious diseases, these reports to be made by the physician as soon as the disease is discovered. (Ibid., sec. 10; also Compiled Laws, 1909, sec. 349.)

In cities of the first class physicians report to the city superintendent of public health, upon forms prescribed and furnished by the State board of health, all cases of infectious and contagious diseases as soon as discovered. (Ibid., sec. 11; also Compiled Laws, 1909, sec. 350.)

Practicing physicians are required to report the cases of contagious and infectious diseases which have occurred in their practices during the month to the county superintendent or the city superintendent of public health, as the case may be, on the last day of each month. (Rules and regulations promulgated by the State commissioner of health pursuant to sec. 2, ch. 79, Session Laws 1907–8, rule 16.)

Tuberculosis is declared to be an infectious and communicable disease, dangerous to the public health, and it is made the duty of every physician to report in writing to the health officer of the city, town, or village, within 24 hours, the name, age, sex, color, occupation, place where last employed if known, and address of every person known by said physician to have tuberculosis. (Ibid, rule 41.)

It is also made the duty of the chief officer having charge for the time being of any hospital, dispensary, or asylum, or other similar public or private institution, to report in like manner the name, age, sex, color, occupation, place where last employed if known, and previous address of every patient having tuberculosis who comes into his care or under his observation, this report to be made within 24 hours. (Ibid., rule 41.)

Local health officers.—The city and county superintendents of health are required to make a report on the 10th day of each month to the State commissioner of health of all cases of contagious and infectious diseases reported to them for the preceding calendar month. (Ibid, rule 16.)

OREGON.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of seven members. The board elects a secretary, who becomes, by virtue of such election, a member of the board, and is known as the State health officer. (Oregon Acts, 1903, p. 82.)

Counties.—The county judge and county commissioners constitute ex officio a board of health for the county and elect a secretary, who becomes health officer.

Cities.—The mayor and common council of each incorporated city constitute a board of health for the city, except where boards of health are constituted by statute or city ordinance. Each board elects a secretary, who becomes health officer of the board. (Acts of 1905, ch. 170, as amended by ch. 82, Acts of 1907.)

MORBIDITY REPORTS.

Physician.—Every physician or other person having charge of a case of any infectious or epidemic disease must report the case immediately to the county or city health officer. (Acts of 1903, p. 82, sec. 12.)

It is the duty of every practicing physician to report to the county health officer, or to the health officer of the municipal corporation, within 24 hours, by the quickest means of communication, cases of diphtheria, membranous croup, scarlet fever, cholera, typhus fever, typhoid fever, smallpox, measles, cerebrospinal meningitis, ophthalmia neonatorum, infantile paralysis, bubonic plague, leprosy, barber's itch, and tuberculosis. (Rule 1, Oregon State Board of Health, 1911.)

It is the duty of the superintendent of any State institution or of any children's home, or other institution of a public nature, to report to the secretary of the State board of health any of the diseases enumerated in the preceding paragraph by the 10th day of each month for the preceding calendar month. (Rule 3, Oregon State Board of Health, 1911.)

It is also made the duty of every physician called to attend a person sick, or suspected of being sick, or in the absence of a physician, the householder, to report in writing within 24 hours, giving the name, and residence, all cases of cholera, yellow fever, smallpox, diphtheria, membranous croup, scarlet fever, typhus fever, typhoid fever, or "bubonic" (sic), or any other contagious disease, to the county health officer, or other health officer having jurisdiction. (Rule 17, Oregon State Board of Health, 1911.)

Local health authorities.—It is the duty of the county board of health to report to the secretary of the State board of health monthly, not later than the 10th day of the month, all cases of infectious disease which have been reported to the county board during the preceding month. Cities which keep their own records report direct to the State board of health in the same manner as the county boards. (Acts of 1903, p. 82, sec. 8.)

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—There is a department of health, consisting of a commissioner of health and an advisory board. The commissioner is a physician, is the head of the department, and is appointed by the governor. (Laws of 1905, act 218, sec. 1.)

Districts.—In order to insure the management of the sanitary affairs and the registration of vital statistics in the different parts of the State, the commissioner of health is authorized to apportion the State into 10 districts and to appoint a physician in each district to be health officer and to have, under the direction of the commissioner, supervision and control of the sanitary affairs of the district and the registration of vital statistics. The commissioner of health may also appoint and employ such assistants to the health officers of the districts as he may deem necessary. (Laws of 1905, act 218, sec. 11.)

Pursuant to the above, a physician of five or more years' experience in the practice of medicine has been appointed in each county by the State department of health to act as a representative of the department. Townships in which there are no local boards of health have been grouped into about 700 districts, in each of which is a local health officer (not necessarily a physician) appointed and paid by the State department of health.

Townships of the first class (that is, townships with a population of at least 300 to the square mile).—It is the duty of the township commissioners to appoint a township board of health of five members, of whom one must be a physician. The board elects a health officer. (Laws of 1907, act 228, sec. 1.)

Cities.—Cities of the first class: In cities of the first class (cities with a population of over 1,000,000) there is a board of health of three members appointed by the mayor. One member is designated as the chief of the board of health, and is president of the board. The director of public health and charities is the chief executive officer of the board. (Purdon's Digest, p. 2925, secs. 786, 788; 1903 Public Laws, 157, sec. 4.)

Cities of the second class: In cities of the second class (cities with a population of between 100,000 and 1,000,000) there is a bureau of health, which is connected with and under the control of the department of public safety. The director of the department of public safety appoints a superintendent of the bureau of health, and such other employes as are necessary. (Purdon's Digest, p. 3024, sec. 107; 1895 Public Laws, 350, sec. 1.)

Cities of the third class: The council of any city of the third class (cities with less than 100,000 inhabitants) may by ordinance create a board of health, consisting of five members. (Laws of 1889, Art. XI, p. 306.)

Boroughs (incorporated villages with over 300 inhabitants).—It is the duty of the president of the town council or burgess, where he is the presiding officer, to appoint a board of health of five members. (Purdon's Digest, Vol. I, p. 532; 1893 Public Laws, 44.)

MORBIDITY REPORTS.

Physicians.—Every physician practicing in any portion of the State who treats or examines any person suffering from or afflicted with actinomycosis, anthrax, bubonic plague, cerebro-spinal meningitis (epidemic), cerebro-spinal fever (spotted fever), chickenpox, Asiatic cholera, diphtheria (diphtheritic croup, membranous croup, putrid sore throat), epidemic dysentery, erysipelas, German measles, glanders (farcy), rabies (hydrophobia), leprosy, malarial fever, measles, mumps, pneumonia (true), puerperal fever, relapsing fever, scarlet fever (scarlatina, scarlet rash), smallpox (variola, varioloid) tetanus, trachoma, trichiniasis, tuberculosis in any form, typhoid fever, typhus fever, whooping cough, uncinaria duodenalis (hook worm),[1] pellagra,[1] anterior poliomyelitis (infantile paralysis),[1] or yellow fever is required, if said case is located in a township of the first class, a borough, or a city, to forthwith make a report in writing to the health authorities of said township, city, or borough; and, if the case is located in a township of the second class, or a city, borough, or township of the first class not having a board of health or body acting as such, to the State department of health, upon blanks supplied for that purpose, in which report he shall, over his own signature, state the name of the disease, and the name, age, sex, color, nativity, and occupation, if any, of the person suffering therefrom, together with the street and house number of the premises in which said person may be located, or otherwise sufficiently designate the same, the date of the onset of the disease, the name and occupation of the householder in whose family the disease may have occurred, the number of children in said household attending school, and the name or names of the school or schools so attended, together with such other information relating to said case as may be required by said health authorities and the State department of health. (Laws, 1909, act 658, sec. 1.)

Local health authorities.—The health authorities of the several cities, boroughs, and townships of the first class are required at the end of each week, and for the fraction of each week occurring at the end of the month, to report to the State department of health, upon blanks supplied for that purpose, a list of all cases of communicable diseases mentioned in the preceding paragraph, which have been reported to them during said period; which report is to contain the name of each person suffering therefrom, respectively, and his or her age, sex, color, and nativity, together with the name of the disease and the date of the onset thereof; and in the event of no reports of any of said diseases having been received by the aforesaid health authorities, respectively, during any said period, that fact is required to be reported to the State department of health. All superintendents and other persons in charge of asylums, hospitals, or other institutions located in townships of the second class are required, at the end of each week, and portion of a week occurring at the end of each month, to report to the State department of health, on blanks supplied for that purpose, a list of the inmates of such institutions, respectively, who may have suffered from any of the diseases enumerated in the preceding paragraph, together with the above-mentioned data relative to each inmate, with the date of his or her admission to the insti-

[1] Added to list of reportable diseases by regulation adopted by the advisory board of the State department of health July 7, 1910, pursuant to act 218, approved Apr. 27, 1905.

tution, and the name of the city, borough, or township from which he or she was admitted. (Laws, 1909, act 658, sec. 23.)

Midwives and nurses.—Whenever one or both eyes of an infant become inflamed or swollen or reddened at any time within two weeks after birth, it is the duty of the midwife or nurse, or other person having care of the infant, to report the facts to the health officer or a legally qualified practitioner, in writing, within six hours after the discovery of the condition. (Public Laws, 1895, p. 373, sec. 1, Purdon's Digest, 13th ed., p. 1886, sec. 78.)

PORTO RICO.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

Island.—The governor appoints a member of the executive council to be director of health, charities, and corrections. (Laws of 1904, p. 89.) The director of health, charities, and corrections appoints an insular board of health and a director of sanitation. The director of sanitation is the chief sanitary officer of the island and the executive officer of the board of health. The chairman of the insular board of health is the chief of the bureau of vital statistics. (Laws of 1911, act 68, secs. 1–3.)

Sanitary districts.—For sanitary purposes the island is divided into four sanitary districts. Each district is in charge of a sanitary inspector appointed by the director of sanitation. (Ibid., sec. 17.)

Sanitary zones.—Each sanitary district is divided into sanitary zones. Each zone is in charge of a health officer under the immediate orders of, and appointed by, the director of sanitation. Each sanitary zone has a board of health of three members. (Ibid., secs. 22–23.)

Towns.—A sanitary police agent is appointed in each town having less than 10,000 inhabitants and at least two in towns having over 10,000 inhabitants. (Ibid.)

MORBIDITY REPORTS.

Notifiable diseases.—Exanthematic typhus, typhoid fever, smallpox, varioloid, scarlet fever, diphtheria, yellow fever, asiatic cholera, bubonic plague, beriberi, epidemic dysentery, cerebro-spinal meningitis, whooping cough, epidemic parotiditis, malaria, tuberculosis, glanders, leprosy, cutaneous syphilis, and hookworm disease, or uncinariasis. (Laws of 1911, act 68, sec. 25.)

Physicians.—Physicians are required to report cases of the above-named diseases to the nearest health officer, and all cases of infectious or contagious diseases treated by them to the local health officer. (Ibid., secs. 25–26.)

Local health officers.—Health officers are required to immediately report to the director of sanitation all cases of infectious or contagious diseases reported to them by physicians. (Ibid., sec. 26.)

RHODE ISLAND.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of seven members. The board elects a physician to be secretary, who becomes

ex officio a member of the board, the commissioner of public health, and State registrar. (General Laws of Rhode Island, 1909, ch. 115, p. 415.)

Towns (townships).—The town councils and boards of aldermen constitute ex officio boards of health in their respective towns. (Ibid., ch. 50, p. 232.)

The town council is required to appoint a health officer. (Ibid., ch. 107, sec. 5.) The cities of Providence and Newport and such other towns as may establish a board of health or elect a superintendent of health are exempt from these provisions. (Ibid., sec. 7.)

Cities.—The city council of any city may appoint a board of health for the city, which may have any or all the powers and duties of the board of aldermen as a board of health as the city council may determine. (Ibid., ch. 50, p. 232.)

MORBIDITY REPORTS.

Physician, householder, etc.—Every householder is required to immediately inform the town council of the town wherein he dwells of any person in the house or tenement occupied by him who has smallpox or any other contagious or infectious distemper, or is suspected of being so affected. Every physician, householder, or other person having knowledge of the existence of smallpox in any town is required to immediately notify the town clerk, or, in cities, the superintendent of health. (General Laws, Rhode Island, 1909, ch. 110, secs. 13, 19.)

Any physician who discovers a case of poliomyelitis, tuberculous meningitis, or cerebrospinal meningitis is required to immediately report the existence of each and every case to the secretary of the State board of health. (Laws 1911, ch. 728, sec. 1.)

Physicians are to report to the secretary of the State board of health within seven days, upon blanks provided by the State board for the purpose, the name, sex, age, color, occupation, social condition, and residence of persons under their care affected with pulmonary or laryngeal tuberculosis. (Acts of 1909, ch. 386, sec. 12.)

Institutions.—The superintendent or other person in charge or control of any hospital, school, reformatory, or other institution deriving the whole or any part of its support from the public funds of the State, having in charge or under his care and custody any person suffering with pulmonary or laryngeal tuberculosis, is to make or cause to be made, within 48 hours, a record of name, age, sex, color, occupation, social condition, and residence of the person affected, this information to be forwarded each week to the secretary of the State board of health. (Ibid., sec. 11.)

Midwives, nurses, etc.—Midwives or nurses in charge of infants under 2 weeks of age are to report to the health officer within 6 hours in writing or to a physician, whenever the eyes of such infant become inflamed. (General Laws, 1909, ch. 343, sec. 25.)

State.—It is the duty of the State board of health to keep a register of all persons known to be affected with laryngeal or pulmonary tuberculosis. (Acts of 1909, ch. 386, sec. 10.)

SOUTH CAROLINA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The State board of health consists of the South Carolina Medical Association, together with the attorney and comptroller general of the State. The above-named medical association every seven years elects seven members to be recommended to the governor for appointment to cooperate with the State officers named to constitute an executive committee, having power to act in the intervals between sessions of the State board of health. Upon the recommendation of the executive committee the governor appoints a State health officer, who becomes secretary and executive officer of the State board of health. The executive committee is authorized to divide the State into health districts, and in districts in which there are no boards of health it is required to appoint subboards of health.

The State board of health is invested with authority to direct and supervise the action of local boards of health in cities, towns, and townships, and may remove members of the local boards of health for cause. (South Carolina Code, 1902, Title VIII, Ch. XXIII, and Act No. 433, 1908.)

Cities, towns, and villages.—It is the duty of the mayor or intendant of every incorporated city, town, or village to appoint a board of health, which shall elect a secretary and a health officer. (South Carolina Code, 1902, Title VIII, Ch. XXIII.)

The executive committee of the State board has power and it is its duty to appoint local boards of health in all unincorporated towns and villages of more than 100 population. (Act No. 82, 1906.)

MORBIDITY REPORTS.

Notifiable diseases.—The State board of health is authorized to name the diseases it considers contagious and infectious. (Act No. 395, 1910, sec. 4.) The executive committee of the board has named the following: Tuberculosis, typhoid fever, diphtheria, scarlet fever, smallpox, measles, whooping cough, epidemic cerebrospinal meningitis, leprosy, and poliomyelitis.

Physicians.—It is the duty of physicians in incorporated cities and towns to report to the secretary of the local board of health within 24 hours cases of contagious or infectious disease occurring within their practice. Physicians outside of incorporated cities and towns report within 24 hours direct to the secretary of the State board of health upon blanks furnished by the State board. (Act No. 395, 1910, secs. 1, 3.)

Midwives and nurses.—In cities having over 1,000 inhabitants midwives and nurses are to report at once to the local board of health whenever an infant under their charge has reddened or inflamed eyes. (Criminal Code, 1902, sec. 331.)

Local boards of health.—It is the duty of secretaries of local boards of health to report to the secretary of the State board of health, not later than the 5th day of each month, all cases of contagious and infectious disease reported to them during the preceding month, the report to be made upon blanks furnished by the State board. (Act No. 395, 1910, sec. 2.)

SOUTH DAKOTA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The State board of health consists of five physicians appointed by the governor. The board annually elects a superintendent, who is ex officio secretary of the board. (Political Code, 1903, secs. 238, 240, as amended by ch. 217, Laws of 1903.)

Counties.—Provision is made for a county board of health in each county, consisting of the State's attorney of the county, and two physicians appointed by the State board of health, one of whom shall be superintendent of the county board and ex officio its secretary; the other shall be vice president of the board. (Ibid., sec. 246.)

Cities.—City councils have the power to appoint a board of health for their respective cities and to prescribe its powers and duties. (Ibid., sec. 1229.)

MORBIDITY REPORTS.

Physicians.—Whenever any physician shall know or suspect that any person whom he is called to visit has smallpox, scarlet fever, diphtheria, measles, cholera, or any other disease dangerous to the public health, such physician shall give notice immediately, including the location and a full description of the case, to the superintendent of the county board of health within whose jurisdiction the case occurs. (Regulations State board of health, rule 5.)

All cases of poliomyelitis, or suspected cases are to be reported immediately by the attending physician, or head of the family, to the county board of health. (Regulations State board of health, Sept. 28, 1910.)

Householders.—Whenever any householder shall know or suspect that any person in his family or temporarily residing with him is sick with smallpox, scarlet fever, diphtheria, cholera, or any other disease dangerous to the pubilc health he shall immediately give notice to the health officer having jurisdiction. (Ibid., rule 4.)

Municipal health officers.—City and town health officers are required to record the returns of all contagious and infectious diseases and to forward the returns monthly to the county superintendent of health. (Ibid., rule 15.)

County superintendents.—Superintendents of county boards of health are required to report immediately to the superintendent of the State board of health whenever any contagious or infectious disease occurs in their respective counties. (Political Code, 1903, sec. 248.)

TENNESSEE.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of three physicians, one live-stock breeder, and ex officio the State commissioner of agriculture. (Acts of 1897, ch. 46, sec. 1.)

Counties.—The county judge, court clerk, and health officer or jail physician constitute the county board of health, the last named being president of the board. (Law passed Apr. 4, 1885, sec. 1.)

It is the duty of county courts in counties having jails to appoint a jail physician or health officer. (Ibid., sec. 4.)

Cities.—Every municipality having 5,000 or more inhabitants is required to organize a board of health. (Laws of 1877.) Boards of health of cities and towns have jurisdiction and authority in the territory extending 1 mile from the corporation limits, provided such jurisdiction shall not extend beyond the limits of the county in which the municipality is situated, and provided that where two cities lie less than 2 miles apart the distance be divided between them. (Laws of 1877, ch. 28, sec. 7.)

MORBIDITY REPORTS.

Notifiable diseases.—Smallpox, yellow fever, cholera, bubonic plague, typhus fever, diphtheria, membranous croup, scarlet fever, or other communicable disease (except venereal diseases). (Acts of 1905, ch. 519, sec. 1.) The State board of health by resolution added poliomyelitis to the preceding list October 4, 1910.

The cards issued for the monthly report of contagious diseases contain, in addition to the above-named diseases, the following: Pulmonary tuberculosis, typhoid fever, cerebrospinal meningitis, measles, chicken pox, whooping cough, and pellagra.

Householders.—Whenever any one of the above-named diseases exists, or is suspected to exist in any household, it is the duty of the head of the household or any other person in the household having knowledge of the facts to immediately notify the municipal or county health authorities. (Ibid.)

Physicians.—It is also the duty of physicians to immediately report cases of the above-named diseases to the municipal or county health authorities. (Ibid., sec. 2.)

Nurses, midwives, etc.—Nurses, midwives, or other persons having care of infants under 2 weeks of age are to report immediately to the health officer or a legally qualified practitioner of medicine whenever one or both eyes of an infant become inflamed or reddened. (Acts of 1911, ch. 10, sec. 1.)

Local health authorities.—It is the duty of municipal and county boards of health upon receiving information of the existence or suspected existence of any case of smallpox, cholera, yellow fever, scarlet fever, diphtheria, or other disease dangerous to the public health to immediately notify the State board of health of the fact, and on the first of each month make a written report to the State board of health of all cases of communicable disease occurring in their respective jurisdictions during the preceding calendar month. (Acts of 1905, ch. 519, sec. 11.)

TEXAS.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—There is a State board of health consisting of seven members appointed by the governor. Each member must be a legally qualified practicing physician, who has been in the actual practice of medicine in the State of Texas for at least 10 years. One member is designated by the governor as State health officer and is the president and executive officer of the board. (Laws of 1909, ch. 30, sec. 1.)

The president of the board appoints a registrar of vital statistics who is also the secretary of the board. (Ibid., sec. 4.)

The county and city health officers are under the general direction of the State board of health to which they are required to make such reports as the State board may require. (Ibid., secs. 25, 26, 28.)

Counties.—It is the duty of the commissioner's court of each organized county to appoint a competent physician to be county health officer. (Ibid., secs. 17, 18, 19.)

Cities.—It it the duty of the city council or the city commissioners, as the case may be, of each incorporated city and town within the State to elect a competent physician to the office of city health officer, except in cities where a different method of selecting city health physicans is provided for by charter, in which event the office of city health officer is to be filled as is provided for that of city physician. (Ibid., secs. 21, 22.)

MORBIDITY REPORTS.

Notifiable diseases.—The following-named diseases are classed as contagious: Asiatic cholera, bubonic plague, typhus fever, yellow fever, smallpox, scarlet fever, diphtheria, epidemic cerebrospinal meningitis, dengue, typhoid fever, epidemic dysentery, trachoma, tuberculosis, anthrax. (Acts of 1909, ch. 30, sec. 10, rule 3, as amended by acts of 1911, ch. 95, sec. 1.)

Physicians, etc.—Physicians are to report in writing or by telephone to the local health authority (city or county health officer, or local board of health) immediately each patient known to have or suspected of having a contagious disease. If the disease is pestilential in character the physician is to notify the president of the State board of health by telegraph or telephone at State expense. (Ibid., rule 1.)

Every hotel proprietor, keeper of a boarding house, or inn, or householder, or head of a family in a house wherein any case of reportable contagious disease occurs, is required to report such case to the local health authority within 12 hours unless previous notice has been given by the physician in attendance. (Ibid., rule 23.)

Midwives, nurses, etc.—Persons not practitioners of medicine are to report cases of inflammation of the eyes of infants under their care to the local health authority or to a reputable physician within 12 hours. (Ibid., 10, rule 22.)

Local health authorities.—City and county health authorities are required to keep a record of all cases of contagious disease reported to them including the name, age, sex, race, and location of the persons affected. They are also required to report these cases by the fifth of each month for the preceding calendar month to the president of the State board of health on blanks furnished by the State board. The reports on tuberculosis are to be considered confidential. (Ibid., rule 4.)

UTAH.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of seven members appointed by the governor. A majority of the members must be physicians and one a civil engineer. (Compiled Laws 1907, sec. 1096.)

Counties.—Each board of county commissioners is required to divide the county, outside of incorporated municipalities, into sani-

tary districts and to appoint a health officer for each district. The district health officers, together with the board of county commissioners, constitute the county board of health. (Ibid., sec. 1106.)

Cities.—It is the duty of the board of trustees or the city council of every incorporated town and city to establish by ordinance a board of health of three or more members, one of whom shall, when practicable, be a physician and the executive officer of the board and be known as the health officer. (Ibid., sec. 1105.)

MORBIDITY REPORTS.

Physicians, etc.—It is the duty of every physician or other person caring for the sick to report immediately to the local board of health cases of scarlet fever, diphtheria, whooping cough, smallpox, typhoid fever, measles, tuberculosis, cholera, rubella, chickenpox, typhus fever, plague, cerebrospinal meningitis, poliomyelitis, leprosy, or pneumonia coming under his charge. (Ibid., sec. 1113x11, as amended by laws of 1911, ch. 75, sec. 1.)

Every physician and every superintendent of a hospital or public institution is required to immediately report to the State board of health every case of tuberculosis which he is called upon to treat or which is in such hospital or public institution. (Ibid., sec. 1113x27.)

All physicians or other persons having knowledge of the existence of any contagious or infectious disease, or having reason to believe that any such disease exists, are required to report the fact immediately to the local board of health. (Ibid., sec. 1111.)

It is the duty of every physician and every superintendent or manager of a hospital or public institution to immediately report to the local board of health every case of venereal disease which he is called upon to treat, or which may be in such hospital or institution, and to make such reports as may be called for by the regulations of the State board of health. The name of the person affected is not to be included in the report. (Laws of 1911, ch. 90, sec. 1.)

It is the duty of physicians and midwives to report to the local board of health within six hours every case where a newly born child has inflammation of the eyes attended by a discharge. (Laws 1911, ch. 61, sec. 1.)

Local health authorities.—Local boards of health or health officers report to the secretary of the State board of health monthly on or before the 5th day of each month all cases of scarlet fever, smallpox, diphtheria, membranous croup, typhoid fever, whooping cough, measles, chickenpox, pneumonia, and tuberculosis which have occurred in their respective jurisdictions during the preceding month. (Compiled Laws, 1907, sec. 1108.)

Upon receipt of a notification of inflammation of the eyes of a newly born child, the local health officer is to report immediately by telephone or telegraph to the State board of health. (Regulations, State board of health, 1911.)

VERMONT.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of three members appointed by the governor. The board appoints a physician as secretary and may also appoint a sanitary engineer and inspector. (Public Statutes, 1906, secs. 5409 and 5411.)

Towns (townships).—The State board appoints a health officer for each town. The health officer, together with the selectmen of the town, or the board of aldermen of the city constitutes a local board of health for such town or city. (Ibid., secs. 5433 and 5434.)

MORBIDITY REPORTS.

Physicians, etc.—Physicians are required to report immediately to the local health officer cases of communicable disease dangerous to the public health giving the location of the cases, the name of the patient, and the degree of virulence, cause, and source of the disease. The head of a family in whose home there occurs a case of infectious or contagious disease dangerous to the public health is required to immediately notify the local health officers. (Public Statutes, 1906, sec. 5454.)

Physicians are required to report cases of tuberculosis to the secretary of the State board of health, giving the name and address of the person affected. (Ibid., sec. 5450.)

Nurses, etc.—It is made the duty of the nurse, relative, or other person having charge of an infant to report in writing within six hours thereafter to the local health officer of the town or city in which the parents of the infant reside, whenever one or both eyes of an infant become inflamed, swollen, or reddened, and have an unnatural discharge at any time within two weeks after its birth. (Regulation, State board of health.)

Local health authorities.—Upon receiving notice of a case of contagious or infectious disease dangerous to the public health, local health officers are to immediately report the facts of the case to the secretary of the State board of health. When a communicable disease prevails or becomes epidemic, the local health officer is to make weekly reports concerning the disease to the State board. (Ibid., sec. 5455.) Local health officers are to report to the secretary of the State board of health immediately every case of smallpox, varioloid, Asiatic cholera, typhus fever or yellow fever occurring within their respective jurisdictions. (Ibid., sec. 5453.)

VIRGINIA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—There is a State board of health consisting of 12 members appointed by the governor, one from each congressional district and two additional from the city of Richmond. The governor also appoints a health commissioner who is the executive officer of the State board of health, although not a member of the board. (Pollard's Code, Biennial, 1908, sec. 1713d.)

Counties, towns, and cities.—The State board of health appoints annually three physicians of each county or corporation, who, with

the chairman of the supervisors or the mayor of the corporation, as the case may be, constitute a county, town, or city board of health. This does not apply to cities or towns whose charters provide for the creation of a board of health. Each board elects one of its medical members to be secretary and health officer.

MORBIDITY REPORTS.

Notifiable diseases.—The State board of health is authorized to prepare and promulgate from time to time a list of diseases considered as infectious, contagious, communicable, or dangerous, and of which cases are to be reported, and to prescribe the manner and time of the report. (Ibid., sec. 2.)

In compliance therewith the State board, in rule 30 (effective Nov. 1, 1910), requires every physician to report immediately to the secretary of the local board of health having jurisdiction, every case of the following-named diseases occurring in his practice: Smallpox, Asiatic cholera, bubonic plague, diphtheria, scarlet fever, and yellow fever. These diseases are termed reportable diseases, Class I. Rule 31 (effective Nov. 1, 1910) requires every physician to report to the secretary of the local board of health having jurisdiction, once each month, cases of the following-named diseases occurring in his practice: Typhoid fever, measles, chickenpox, tuberculosis, and hookworm disease. These are termed reportable diseases, Class II.[1]

Physicians.—Every practicing physician who knows or suspects that any person whom he is called upon to visit, or who comes to him for examination or treatment, is suffering from any infectious, contagious, communicable, or dangerous disease is to report in writing, on blanks to be furnished for that purpose by the State board of health, to the executive officer of the board of health of the county, town, or city in which such person may be located, over his or her own signature, stating the name of the disease, and name, color, sex, and age of the person suffering therefrom, together with the street and number or such other sufficient designation of the house, room, or other place in which said person may be located, and giving such other information as may be deemed necessary by said health authorities. (Acts of 1910, ch. 307, sec. 1.)

Local health authorities.—It is the duty of the local authorities of the cities, towns, and counties of the State to report weekly to the State board of health all cases of infectious, contagious, communicable, or dangerous diseases which have occurred within their respective jurisdictions, except that it shall be their duty to report immediately any case or cases of smallpox, yellow fever, cholera, typhus fever, or bubonic plague that may occur. (Acts of 1910, ch. 340, sec. 7.)

WASHINGTON.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—There is a State board of health of five members appointed by the governor. (Ballinger's Code, ch. 10, sec. 2956.) These five so appointed elect a physician, who may or may not be a member of the board, to be State commissioner of health. The State commissioner of health is ex officio secretary and executive officer of the State board of health. (Acts of 1909, ch. 208, secs. 1, 2.)

[1] Poliomyelitis was made notifiable during the early part of 1911. (Letter, State Commissioner of Health, Oct. 31, 1911.)

The State board of health may remove from office any health officer who refuses or neglects to make prompt and accurate reports to the county health officer or to the State board of health, and any officer thus removed may not again be reappointed, except with the consent of the State board. (Acts of 1907, ch. 85, sec. 5.)

Counties.—The board of county commissioners in each county constitutes a county board of health having jurisdiction throughout the county, excepting in cities of the first class (cities having a population of over 20,000). This board appoints a physician as health officer, who becomes ex officio a member of the board and its executive officer. (Ibid, sec. 1.)

Cities.—The mayor of each incorporated city and town is required to appoint a physician as health officer of the city or town. This, however, does not apply to cities of the first class (cities with over 20,000 inhabitants). Nor does it apply to cities of the second class (cities with between 10,000 and 20,000 inhabitants) having a board of health, in which the health officer is appointed by the board of health. (Ibid, sec. 2.)

In cities of the first class, except in those having a board of health organized and a health officer appointed under the provisions of a special charter, the council organizes as a board of health, or appoints wholly or partially from its own members a suitable number of persons to act as such a board. This board appoints a health officer, who is ex officio a member of the board and its executive officer. (Ballinger's Code, 1897, sec. 1237.)

MORBIDITY REPORTS.

Notifiable diseases.—The State board of health is authorized to designate the diseases which shall be construed as dangerous, contagious, or infectious. (Remington and Ballinger's Annotated Codes and Statutes, 1910, sec. 5547.)

The State board of health has declared the following-named diseases to be contagious or infectious, and dangerous to the public health, and, as such, to be reported by physicians: Anterior poliomyelitis, Asiatic cholera, beriberi, chickenpox, diphtheria (or membranous croup), epidemic cerebro-spinal meningitis, favus, leprosy, measles, plague, pellagra, scarlet fever (scarlatina or scarlet rash), smallpox, pulmonary and abdominal tuberculosis, trachoma, typhoid fever, typhus fever, uncinariasis (or hookworm disease), whooping cough, yellow fever, and so-called cedar, Cuban, dobe, Egyptian, Japanese, kangaroo, Manila, or Philippine itch. (Rules and regulations State board of health, 1910, p. 6.)

(NOTE.—So-called cedar, Cuban, dobe, Egyptian, Japanese, kangaroo, or Manila itch are different names at times erroneously used for mild forms of smallpox.)

Smallpox is to be immediately reported by the attending physician, or in his absence by the head of the family or householder, to the local health officer. (Rules and regulations State board of health, 1910, p. 4.)

Physicians.—Physicians are required to report within 24 hours to the local health officer having jurisdiction (in cities to the city health officer; outside of cities, to the county health officer) cases of dangerous, contagious, or infectious diseases, or diseases required by the

State board of health to be reported. (Remington and Ballinger's Code, 1910, sec. 5545.)

Every physician is also to report immediately to the local health officer every case of obscure eruptive disease of the nature of which he is in doubt. (Rules and regulations State board of health, 1910, p. 6.)

Householders.—Whenever any householder knows that any person within his household is affected with an acute disease, accompanied with eruption of the skin, said householder shall immediately notify either the proper health officer or the family physician. (Rules and regulations State board of health, 1910, p. 6.)

City health officers.—All city health officers (except those of cities of the first class) are to report immediately in duplicate to the county health officer and to the State commissioner of health every new outbreak (that is, first case or cases) of any contagious or infectious disease within their respective jurisdictions, and thereafter are to report weekly all contagious and infectious diseases to the county health officer only. If no contagious or infectious disease is present within their jurisdictions, report of the fact is to be made to the county health officer not less than once each month. (Rules and regulations State board of health, 1910, p. 4.)

Health officers of cities of the first class (having a population of over 20,000) make the same reports, and are governed by the same rules as the county health officers, unless otherwise specified, and communicate directly with the State commissioner of health. (Rules and regulations, State board of health, 1910, p. 4.)

County health officers.—County health officers are to make monthly reports of all contagious or infectious diseases to the State commissioner of health, by the 5th day of the month for the preceding calendar month. Local health officers send the original reports received or filled out by them to the county health officer, who makes and keeps a record of each case, and who, in addition to his monthly report, forwards therewith to the State commissioner of health the original reports of individual cases of typhoid fever, tuberculosis, epidemic cerebro-spinal meningitis, anterior poliomyelitis, hookworm disease, and pellagra. If no infectious or contagious diseases occur during the month, such fact must be reported.

The county health officer makes his monthly report on blanks furnished by the State commissioner of health, and is to indicate thereon the geographic distribution of cases within his jurisdiction, the cities where no contagious or infectious diseases have occurred during the month, and cities which have neglected to make reports.

Immediately upon learning of the first case of Asiatic cholera, chicken pox in adults, diphtheria, plague, scarlet fever or scarlet rash, smallpox, yellow fever, or typhus fever, within their respective jurisdictions, county health officers must notify the State commissioner of health, and after investigation, send a report stating fully the source of infection and probable number of persons exposed from this or previously unknown cases, the danger of the disease spreading, and what measures have been taken for its control; and thereafter they are to make reports of the course of the disease, as long as cases remain, at such intervals as directed by the commissioner of health. (Rules and regulations, State board of health, 1910, p. 4.)

WEST VIRGINIA.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health consisting of two physicians from each of the five congressional districts of the State. (Code of 1906, ch. 150.)

Counties.—It is made the duty of the county court to nominate and the State board of health to appoint three persons in each county who, together with the president of the county court and the prosecuting attorney for the county, shall constitute the county board of health. One member of this board is to be a physician, who becomes the executive officer of the board and the county health officer. The county board is to enforce within the county, outside of municipalities, the rules and regulations of the State board of health. (Code of 1906, ch. 150.)

Cities.—It is made the duty of the council of every incorporated city, town, or village to nominate, and the State board of health to appoint, in each incorporated city, town, or village three persons, one of whom shall be a physician, who, together with the mayor and city solicitor, if there be a city solicitor, constitute a board of health for the municipality, the physician on the board to be health officer. The boards of health of incorporated cities, towns, and villages are independent of the county board, and are auxiliary to the State board of health.

MORBIDITY REPORTS.

Physicians.—It is the duty of physicians, where there is a local board of health, to report promptly cases of disease of the following character: Cholera, smallpox, scarlet fever, diphtheria, tuberculosis, and other endemic, epidemic, infectious, and contagious diseases. (Code of 1906, sec. 4383.)

City and county boards of health.—City and county boards of health are required to report at least once in every three months to the State board of health the character of all such infectious, contagious, and epidemic diseases (enumerated above), and the number of persons reported as infected, giving their names. (Ibid.)

WISCONSIN.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health and vital statistics of seven members. (Wisconsin Statutes, 1898, sec. 1404.) They elect a secretary, who may be a member of the board. If a person is elected who is not a member of the board, he becomes a member upon election as secretary. (Acts of 1905, ch. 433, sec. 1.)

Towns (townships).—The town board of every town is required to organize as a board of health, and appoint a health officer, who is ex officio a member of the board and its executive officer. (Acts of 1907, ch. 140, sec. 1411.)

Cities.—The village board or common council of every village and city is required to organize as a board of health, and to appoint a health officer, who is ex officio a member of the board and its executive officer. (Ibid.)

MORBIDITY REPORTS.

Dangerous and contagious diseases.—The State board of health has declared the following-named diseases to be "dangerous and contagious": Asiatic cholera (cholerine), yellow fever, smallpox, typhus fever, leprosy, bubonic plague, diphtheria, scarlet fever (scarlatina), typhoid fever, measles (including rotheln), whooping cough, cerebrospinal meningitis. (Rules Wisconsin State board of health, adopted Aug. 7, 1907), and anterior poliomyelitis. (Rules Wisconsin State Board of Health, adopted Jan. 28, 1910.)

Physicians, etc.—Whenever a physician knows or has good reason to believe that any person whom he is attending is sick with a "dangerous, contagious, or infectious" disease, he is required by law to immediately report the case in writing to the local board of health, giving the nature of the disease and the name, age, sex, and place of residence of the person sick. In the absence of an attending physician the report is to be made by the head of the family or the person in charge of the house or building. (Acts of 1909, ch. 85, sec. 1.)

Physicians are required to report to the local board of health the name, age, and address of persons having any of the above-mentioned diseases or tuberculosis, chicken pox, or erysipelas. It is the duty of every physician or person, or owner, agent, manager, principal, or superintendent of every public or private institution or dispensary, hotel, boarding or lodging house, to report to the local (town, city, or village) department of health in writing or to have such a report made by some competent person, giving the name, age, sex, occupation, and latest address of every person afflicted with tuberculosis, who is in his care, or who has come under his observation, within one week. (Acts of 1905, ch. 192.)

Nurses, etc.—When one or both eyes of an infant become inflamed, swollen, and red, and show an unnatural discharge at any time within two weeks after its birth, the nurse, parents, or other attendant having charge of the infant are required to report the case in writing within six hours to the local board of health. (Acts of 1909, ch. 59, sec. 1.)

Local health authorities.—It is the duty of every local health officer, upon the appearance of any dangerous or contagious disease within his jurisdiction, to immediately investigate all the circumstances attendant upon the appearance of the disease and make a full report to the State board of health. (Wisconsin Statutes, 1898, sec. 1412.)

WYOMING.

HEALTH ORGANIZATION FOR THE COLLECTION OF MORBIDITY REPORTS.

State.—The law provides for a State board of health of three members appointed by the governor, one member of the board to be a physician, and to constitute the secretary and executive officer of the board. (Acts of 1901, ch. 55, secs. 1, 2.)

Counties.—The State board of health appoints a practicing physician in each county to be county health officer. (Ibid., sec. 3.)

The county health officers are under the direction and supervision of the State board of health, and the State board has authority to make such rules and regulations for the government and direction of county health officers as in its judgment may be best suited to maintain the public health. (Ibid., sec. 18.)

The State board or the county health officer may appoint an assistant county health officer in any locality remote from the residence of the county health officer, whenever the State board of health or the county health officer deem it expedient. (Rules and regulations, State board of health, 1909.)

MORBIDITY REPORTS.

Householders.—Whenever any householder knows or has reason to believe that any person within his family or household has any communicable disease, he is required to immediately give notice thereof to the county health officer or assistant health officer of the county within which he resides, such notice to be given at the office of the health officer within the shortest possible time, and by the most direct means of communication. (Rules and regulations, State board of health, 1909.)

Physicians.—Every practicing and licensed physician is required to make an immediate report of every case of communicable disease occurring in his practice to the county health officer. (Rules and regulations, State board of health, promulgated pursuant to sec. 3, ch. 99, Laws of 1909.)

It is the duty of every practicing or licensed physician to report immediately to the secretary of the State board of health and county health officer by telegram or telephone or in the most expeditious manner, every case of smallpox, cholera, scarlet fever, diphtheria or contagious or infectious disease that is a menace to the public health, said telegram to be paid by the State board of health. (Compiled Statutes 1910, sec. 2942.)

County health officer.—Whenever in any county a case of smallpox, cholera, typhoid fever, scarlet fever, diphtheria, or other epidemic or contagious or infectious disease is known to exist, it is the duty of the county health officer to immediately notify the secretary of the State board of health. (Compiled Statutes, 1910, sec. 2936).

When typhoid fever appears on any premises from which milk is sold, the health officer shall at once report the same to the State board of health. (Rules and regulations, State board of health, 1909.)

County health officers are required to report all cases of communicable diseases reported to them to the State board of health. (Ibid.)

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CERTAIN FEATURES PECULIAR TO THE VARIOUS STATE AND TERRITORIAL LAWS.

ALABAMA.

The Medical Association of the State of Alabama constitutes the State board of health and elects the State health officer.

The county medical societies in affiliation with the State association constitute boards of health for their respective counties and are the only local boards of health, others being prohibited. The county board in each county elects a county health officer, and a health officer for each incorporated city and town.

Beriberi and Chagres fever are among the notifiable diseases.

ARKANSAS.

The jurisdiction of boards of health of cities with over 2,500 inhabitants extends 1 mile beyond the city limits, except in the time of epidemic, when, for quarantine purposes, it extends 5 miles.

There appears to be no requirement for the reporting of sickness.

CALIFORNIA.

Syphilis and gonococcus infection are included among the diseases required by law to be reported by physicians to the local health authorities and by the local health authorities to the State board of health.

Physicians are required to report to the State board of health cases of poisoning by lead, phosphorus, arsenic, or mercury, or their compounds, cases of anthrax, and cases of compressed-air illness, contracted as a result of the nature of the patient's employment, and are entitled to a fee of 50 cents for each such report. (Acts of 1911, ch. 485, sec. 1.)

CONNECTICUT.

The county health officers are attorneys at law, appointed by the judges of the superior court.

DELAWARE.

The governor appoints three physicians in each county to be health officers of the county.

FLORIDA.

Physicians report cases of the notifiable diseases direct to the State health officer, or State board of health—cases of yellow fever, smallpox, and cholera being reported by telegram at State expense. No State provision is made for local health officers or boards, excepting that made in the charters of certain cities.

ILLINOIS.

The council and trustees of cities and villages have for sanitary purposes jurisdiction extending one-half mile beyond the corporation limits.

IOWA.

Cases of the notifiable diseases are in cities and towns reported to the mayor, outside of cities and towns to the clerk of the township.

KENTUCKY.

The law specifies that reports of cases of the notifiable diseases shall be made to the county board of health or some member of the board.

LOUISIANA.

The sanitary code specifies that whenever a quarantinable disease breaks out within the State the president of the State board of health is to immediately notify the health authorities of surrounding States and the Surgeon General of the Public Health and Marine-Hospital Service.

MASSACHUSETTS.

The State is divided into 14 health districts with a State inspector of health in each district.

MICHIGAN.

For each complete report of a notifiable disease made by a physician to the local health authorities the physician is entitled to receive the sum of 10 cents from the township, city, or village in which the notice was given.

For cases of tuberculosis physicians are required to report in addition to the name, age, sex, color, nativity, and address of the patient also the occupation engaged in at the time the disease was contracted and each subsequent occupation engaged in up to the time of recovery or death. When a patient recovers, the fact is also to be reported.

MISSISSIPPI.

Reports of cases of the notifiable diseases are to be made direct to the secretary of the State board of health.

MISSOURI.

There appears to be no State requirement for the reporting of sickness by physicians.

NEVADA.

There appears to be no requirement for the reporting of sickness.

NEW JERSEY.

Physicians attending cases of typhoid fever, dysentery, scarlet fever, diphtheria or tuberculosis on any dairy premises where milk is produced for sale or distribution. or in any household any member

of which is employed at such a dairy, are required to report the cases to the State board of health within 12 hours.

Physicians and householders are entitled to the sum of ten cents for each case of a notifiable disease reported by them. Local authorities are entitled to the same amount for each case reported by them to the state board of health.

NEW MEXICO.

Outside of incorporated cities and towns reports of cases of the notifiable diseases are made to the justice of the peace of the precinct.

NEW YORK.

The physician or other person who reports a case of a notifiable disease is entitled to the sum of 25 cents therefor.

Health officers of villages and towns are paid by their respective village or town a sum not to exceed 20 cents for each case of notifiable disease reported by them to the State department of health.

SOUTH CAROLINA.

Physicians outside of incorporated cities and towns report cases of the notifiable diseases direct to the secretary of the State board of health.

TENNESSEE.

Boards of health of cities have jurisdiction and authority in the territory extending for 1 mile beyond the corporation limits.

UTAH.

The laws of Utah make the penalty for the willful violation of the law in regard to the reporting of infectious diseases the cancellation or revocation of the practitioner's license. (Utah Compiled Laws 1907, sec. 1735-1736, as amended by acts of 1911, ch. 93.)

Physicians are required to report immediately to the local board of health cases of venereal disease.

Upon the notification of a case of inflammation of the eyes in a newly born child the local health officer is required to report immediately by telephone or telegraph to the State board of health.

WASHINGTON.

The State board of health may remove from office any health officer who refuses or neglects to make prompt and accurate reports to the county health officer or to the State board of health.

Diseases notifiable in each of the States and Territories.

[The plus signs (+) indicate the notifiable diseases.]

	States.	Actinomycosis.	Anthrax.	Beriberi.	Cancer.	Cerebro-spinal meningitis.	Chagres fever.	Chicken pox.	Cholera (Asiatic).	Dengue.	Diphtheria.	Dysentery.	Epidemic dysentery.	Erysipelas.	Favus.	German measles.	Glanders.	Gonococcus infection.	Leprosy.	Malaria.	Measles.	Mumps.	Ophthalmia neonatorum.	Pellagra.	Plague.	Pneumonia.	Poliomyelitis.
1	Alabama			+		+	+		+		+						+		+						+		
2	Alaska																										
3	Arizona																										
4	Arkansas																										
5	California [1]		+	+		+		+	+	+	+	+		+		+	+	+	+		+	+		+	+	+	+
6	Colorado								+		+																
7	Connecticut [2]								+		+								+				+				
8	Delaware																										
9	District of Columbia					+		+	+		+						+		+		+		(3)		+		+
10	Florida								+		+								+								
11	Georgia								+		+																
12	Hawaii [4]					+		+	+	+	+								+		+				+		+
13	Idaho					+		+	+		+					+			+		+		(5)		+		+
14	Illinois [6]		+						+		+						+		+				(5)		+		
15	Indiana							+	+		+								+		+		(3)		+		
16	Iowa					+			+		+								+				(5)		+		+
17	Kansas					+			+		+																
18	Kentucky								+		+																
19	Louisiana									+													(3)			+	
20	Maine					+			+		+										+		(7)				+
21	Maryland										+										+	+	(5)				
22	Massachusetts	+	+			+		+	+		+						+		+		+		+				+
23	Michigan [8]					+			+		+										+		(5)			+	

[1] California.—Medical practitioners are also to report cases of certain occupation diseases, see page 14.

[2] Connecticut.—See also statement of the secretary of the State board of health, page 16.

[3] When no physician is in attendance, cases of ophthalmia neonatorum are to be reported to the local health officer by the midwife, nurse, or other person in charge of the child. Where a physician is in attendance the case is not reported.

[4] Hawaii.—In addition follicular conjunctivitis, amoebic dysentery and paratyphoid fever are required to be reported.

[5] Cases of ophthalmia neonatorum are to be reported either to a physician or to the local health officer by the nurse, or other person in charge of the child.

[6] Illinois.—Requires certain occupation diseases to be reported also, see page 23.

[7] Maine.—Cases of ophthalmia neonatorum are to be reported to a physician by the nurse or other attendant.

[8] Michigan.—Physicians are also to report cases of certain occupation diseases, see page 33.

Diseases notifiable in each of the States and Territories—Continued.

	States.	Actinomycosis.	Anthrax.	Beriberi.	Cancer.	Cerebro-spinal meningitis.	Chagres fever.	Chicken pox.	Cholera (Asiatic).	Dengue.	Diphtheria.	Dysentery.	Epidemic dysentery.	Erysipelas.	Favus.	German measles.	Glanders.	Gonococcus infection.	Leprosy.	Malaria.	Measles.	Mumps.	Ophthalmia neonatorum.	Pellagra.	Plague.	Pneumonia.	Poliomyelitis.
24	Minnesota					+					+										+		+				+
25	Mississippi [1]								+	+																	
26	Missouri																										
27	Montana					+			+		+										+				+		
28	Nebraska					+		+	+		+								+		+		+				
29	Nevada																										
30	New Hampshire [2]								+		+										+						
31	New Jersey		+					+	+		+						+		+	+			(3)		+		+
32	New Mexico																										
33	New York [4]		+		+	+			+		+								+		+		+	+	+	+	+
34	North Carolina										+										+				+		
35	North Dakota																						(3)				
36	Ohio					+		+	+		+										+		(3)		+		+
37	Oklahoma																										
38	Oregon [6]					+			+		+								+		+		+		+		+
39	Pennsylvania	+	+			+		+	+		+		+	+		+	+		+	+	+	+	(5)	+	+	+	+
40	Porto Rico			+		+			+		+		+				+		+	+		+			+		
41	Rhode Island [7]					+																	(5)				+
42	South Carolina					+					+								+		+		+				+
43	South Dakota								+		+										+						+
44	Tennessee								+		+												(5)		+		+
45	Texas		+			+			+	+	+		+										(5)		+		
46	Utah [8]					+		+	+		+								+		+		+		+	+	+
47	Vermont																						+				
48	Virginia							+	+		+										+				+		+
49	Washington			+		+		+	+		+				+				+		+			+	+		+
50	West Virginia [9]								+		+																
51	Wisconsin					+		+	+		+			+					+		+		+		+		+
52	Wyoming								+		+																
	Number of States in which each disease is notifiable	2	7	4	1	24	1	14	37	5	39	1	3	3	1	3	8	1	21	3	24	4	10	4	22	6	21

[1] **Mississippi.**—In addition to the diseases enumerated it is specified that cases of other virulent epidemic contagious diseases shall be reported.

[2] **New Hampshire.**—In addition to the diseases enumerated malignant pestilential diseases and malignant communicable diseases are to be reported.

[3] When no physician is in attendance, cases of ophthalmia neonatorum are to be reported to the local health officer by the midwife, nurse, or other person in charge of the child. Where a physician is in attendance the case is not reported.

[4] **New York.**—Physicians are also to report cases of certain occupation diseases, see page 156.

[5] Cases of ophthalmia neonatorum are to be reported either to a physician or to the local health officer by the nurse or other person in charge of the child.

[6] **Oregon.**—Barber's itch is also reportable.

[7] **Rhode Island.**—Requires meningeal tuberculosis to be reported also.

[8] **Utah.**—Requires also that venereal diseases shall be reported, see page 58.

[9] **West Virginia.**—In addition other endemic, epidemic, infectious, or contagious diseases are to be reported.

Diseases notifiable in each of the States and Territories—Continued.

	States.	Puerperal fever.	Rabies.	Relapsing fever.	Rocky Mountain (spotted) fever.	Scarlet fever.	Smallpox.	Syphilis.	Tetanus.	Trachoma.	Trichiniasis.	Tuberculosis. All forms.	Tuberculosis. Communicable forms.	Tuberculosis. Abdominal.	Tuberculosis. Laryngeal.	Tuberculosis. Pulmonary.	Typhoid fever.	Typhus fever.	Uncinariasis.	Whooping cough.	Yellow fever.	Contagious or infectious diseases dangerous to the public health.	Communicable diseases.	Contagious diseases.	Diseases dangerous to the public health.	Epidemic diseases.	Infectious diseases.	Pestilential diseases.
1	Alabama		+			+	+									+	+	+			+							
2	Alaska																											
3	Arizona																							+		+	+	
4	Arkansas																											
5	California [1]		+			+	+	+	+	+		+					+	+	+	+	+			+				
6	Colorado					+	+																		+			
7	Connecticut [2]					+	+					+					+	+			+			[3] +			[3] +	
8	Delaware																							+			+	
9	District of Columbia					+	+						+			+	+	+		+	+							
10	Florida					+	+														+							
11	Georgia					+	+											+			+							
12	Hawaii [4]						+		+	+		+					+	+		+	+		+		+		+	
13	Idaho					+	+										+	+		+	+							
14	Illinois [5]					+	+														+							
15	Indiana					+	+									+	+	+		+	+							
16	Iowa					+	+																					
17	Kansas					+	+					+													+			
18	Kentucky					+	+														+		+			+		
19	Louisiana						+									+					+			+			+	+
20	Maine					+	+					+					+	+		+								
21	Maryland					+	+								+	+	+	+		+	+	+						
22	Massachusetts					+	+		+	+	+	+					+	+		+	+							
23	Michigan [6]					+	+					+					+			+								
24	Minnesota					+	+					+					+											
25	Mississippi [7]						+									+					+							
26	Missouri																											
27	Montana				+	+	+										+	+			+							
28	Nebraska	+				+	+					+					+	+		+	+			+	+			
29	Nevada																											
30	New Hampshire [8]					+	+					+					+											
31	New Jersey		+			+	+			+	+	+					+	+			+							
32	New Mexico						+															+						
33	New York [10]		+			+	+		+						+	+	+	+		+	+							
34	North Carolina					+	+											+		+	+							
35	North Dakota																							+		+	+	

36	Ohio					+	+			+							+	+		+	+				+			
37	Oklahoma											+												+			+	
38	Oregon [11]					+	+					+					+	+			+			+		+	+	
39	Pennsylvania	+	+	+		+	+		+	+	+	+					+	+	+	+	+							
40	Porto Rico					+	+	+				+					+	+	+	+	+							
41	Rhode Island [12]						+								+	+								+			+	
42	South Carolina					+	+					+			+					+								
43	South Dakota					+	+																		+			
44	Tennessee					+	+											+			+		b+					
45	Texas					+	+			+		+					+	+			+							+
46	Utah [13]					+	+					+					+	+		+				+			+	
47	Vermont											+										+						
48	Virginia					+	+					+					+		+		+		+	+	+		+	
49	Washington					+	+			+				+		+	+	+	+	+	+							
50	West Virginia [14]					+	+					+																
51	Wisconsin [15]					+	+					+					+	+		+	+							
52	Wyoming					+	+																+					
	Number of States in which each disease is notifiable	2	5	1	1	38	43	2	5	8	3	22	1	1	4	9	26	25	5	19	29	3	5	12	7	4	11	2

[1] California.—Medical practitioners are also to report cases of certain occupation diseases, see page 14.
[2] Connecticut.—See also statement of the Secretary of the State board of health, page 16.
[3] Connecticut.—Diseases of a venereal nature are excepted.
[4] Hawaii.—In addition follicular conjunctivitis, amoebic dysentery and paratyphoid fever are required to be reported.
[5] Illinois.—Requires certain occupation diseases to be reported also, see page 23.
[6] Michigan.—Physicians are also to report cases of certain occupation diseases, see page 33.
[7] Mississippi.—In addition to the diseases enumerated it is specified that cases of other virulent epidemic contagious diseases shall be reported.
[8] New Hampshire.—In addition to the diseases enumerated malignant pestilential diseases and malignant communicable diseases are to be reported.
[9] New Mexico.—Exception is made to venereal diseases.
[10] New York.—Physicians are also to report cases of certain occupation diseases, see page 156.
[11] Oregon.—Barber's itch is also reportable.
[12] Rhode Island.—Requires meningeal tuberculosis to be reported also.
[13] Utah.—Requires also that venereal diseases shall be reported, see page 58.
[14] West Virginia.—In addition other endemic, epidemic, infectious, or contagious diseases are to be reported.
[15] Wisconsin.—It is understood that a law was enacted during the present year requiring the notification of certain occupation diseases, but a copy of the law has not been accessible.

Notifiable diseases and the health authorities to and through whom reported.

	States.	Notifiable diseases.	By whom reported.	To whom reported.	When reported.	Remarks.
1	Alabama	1, leprosy; 2, cholera; 3, typhus fever; 4, cerebrospinal meningitis; 5, yellow fever; 6, scarlet fever; 7, plague; 8, hydrophobia; 9, glanders; 10, smallpox; 11, diphtheria; 12, tuberculosis (pulmonary); 13, typhoid fever; 14, chagres fever; 15, beriberi.	1, physicians; 2, midwives and other persons to report suspected cases.	Local health officer	As soon as can be done	Municipal health officers are to report the presence of any of these diseases promptly to the committee of public health of the county board of health and to the State health officer. County health officers also are to report to the State health officer the presence of any of these diseases in their respective counties.
2	Alaska					
3	Arizona	1, contagious, epidemic, or infectious diseases.	Physicians or other persons	Local board of health	Immediately	The attending physician is to report twice each week the status of the case.
			Keepers of private houses, boarding houses, lodging houses, inns, or hotels.	Local board of health	Within 24 hours	
		1, smallpox; 2, scarlet fever; 3, diphtheria; 4, other infectious or contagious diseases.	Local boards of health (in cities, the city board; for the Territory outside of cities, the county board.)	Territorial board of health	Immediately	
4	Arkansas					The law makes it the duty of the State board of health to have general supervision over the registration of prevalent diseases.
5	California	1, cholera; 2, plague; 3, yellow fever; 4, leprosy; 5, diphtheria; 6, scarlet fever; 7, smallpox; 8, typhus fever; 9, typhoid fever; 10, anthrax; 11, glanders; 12, epidemic cerebrospinal meningitis; 13, tuberculosis; 14, pneumonia; 15, dysentery; 16, erysipelas; 17, uncinariasis;	Physicians, nurses, or other persons having charge of or caring for cases.	Local board of health, or health officer.	At once	
			1, local health officers; 2, members of local boards of health; 3, coroners.	State board of health	At once	

		18, trachoma; 19, dengue; 20, tetanus; 21, measles; 22, German measles; 23, chicken pox; 24, whooping cough; 25, mumps; 26, pellagra; 27, beriberi; 28, syphilis; 29, gonococcus infection; 30, rabies; 31, poliomyelitis.				
			Physicians, nurses, clergymen, attendants, etc.	Local health officer or board of health.	Promptly	
		1, infectious, contagious, and communicable diseases.	1, boards of health of cities and towns, and the chief executive health officer where there is no municipal or town board of health; 2, county health officers.	State board of health	On or before the 5th day of each month.	
		1, plague; 2, Asiatic cholera; 3, yellow fever; 4, typhus fever.	Local boards of health and health officers.	Secretary of the State board of health.	Immediately by telegraph.	
		Poisoning by lead, phosphorus, arsenic, or mercury, or their compounds, anthrax and compressed-air illness when contracted as a result of the nature of the patient's employment.	Physicians	State board of health		
			State board of health	Commissioner of the bureau of labor statistics.		
6	Colorado	1, smallpox; 2, or any other disease dangerous to the public health.	Householders	Local (city or county) health officer.	Immediately	City and county health officers are required to keep the secretary of the State board of health constantly informed respecting every outbreak of a disease dangerous to the public health.
		1, smallpox; 2, cholera; 3, diphtheria; 4, scarlet fever; 5, or other diseases dangerous to the public health.	Physicians	1, local board of health; 2, householder, hotel keeper, keeper of a boarding house or tenant within whose house or rooms the sick person happens to be.	Immediately	
7	Connecticut	1, cholera; 2, yellow fever; 3, typhus fever; 4, leprosy; 5, smallpox; 6, diphtheria; 7, membranous croup; 8, typhoid fever; 9, scarlet fever; 10, or other contagious or infectious diseases, except those of a venereal nature.	Physicians	Health officer of the town (township), city, or borough.	Within 12 hours after the nature of the disease has been recognized.	

Notifiable diseases and the health authorities to and through which reported—Continued.

	States.	Notifiable diseases.	By whom reported.	To whom reported.	When reported.	Remarks.
7	Connecticut (con.)	1, tuberculosis	1, physicians; 2, officers in charge of hospitals, dispensaries, asylums, and other similar institutions.	Health officer of the town (township), city, or borough.	Within 24 hours	
		1, malignant or contagious diseases.	Hotel and lodging-house keepers.	Local board of health	Within 12 hours	
		Ophthalmia neonatorum	Midwife, nurse, or attendant	Local health authority	Within 6 hours	
		1, smallpox; 2, cholera; 3, or any epidemic of infectious disease.	Local health officers	Secretary State board of health.	Immediately.	
		Contagious diseases reported	Health officers of towns (townships), cities, and boroughs.	State board of health	On or before the 8th day of each month for the preceding calendar month.	
		Rabies	Local health officers	Commissioner of domestic animals.	Within 24 hours	
8	Delaware	Contagious or infectious diseases.	Physicians, dentists, veterinary surgeons, or others practicing medicine.	Local or State board of health.	Promptly.	
		Disease dangerous to the public health required by the State board of health to be reported.	Physician or other person having knowledge.	Nearest health authority		
		Contagious or infectious diseases.	Local health authorities	State board of health		
9	District of Columbia.	1, Asiatic cholera; 2, yellow fever; 3, typhus fever; 4, smallpox; 5, leprosy; 6 plague; 7, glanders.	1, physician in attendance; or 2, the head of the family; or 3, the nearest relative present; or 4, any person in attendence.	Health officer	Immediately	
		8, diphtheria; 9, scarlet fever; 10, measles; 11, whooping cough; 12, chicken pox; 13 cerebro-spinal meningitis;	1, physician in attendance; or 2, the head of the family; or 3, the nearest relative present; or 4, any person in at-	Health officer		When the case terminates the person in charge is to report the fact to the health officer.

		14, typhoid fever; 15, poliomyelitis.	tendance.			
		Tuberculosis (pulmonary) or other communicable forms.	1, physicians; 2, officers having charge of hospitals, dispensaries, asylums, and similar institutions.	Health officer	Within 1 week after the disease is recognized.	
		Ophthalmia neonatorum	Midwife or other person in attendance at childbirth other than a registered physician.	Health officer	In writing so that the report shall be received within 6 hours by the health officer.	Physicians are not required to report.
10	Florida	1, yellow fever; 2, smallpox; 3, cholera.	Physicians	1, President of the State board of health; 2, city or county authorities.	Immediately	The report to the State board is to be made by telegram at State expense or in the most expeditious manner.
		1, diphtheria; 2, leprosy; 3, scarlet fever.	1, physicians; or 2, any person having charge of or upon whose premises the case exists.	1, State health officer; or 2, an agent of the State board of health.	Immediately by first mail.	
11	Georgia	1, smallpox; 2, Asiatic cholera; 3, yellow fever; 4, typhus fever; 5, scarlet fever; 6, diphtheria; 7, membranous croup.	1, physicians; 2, householders; 3, heads of families; 4, county or municipal authorities.	Local board of health, or its proper officer.	Immediately	
		1, Asiatic cholera; 2, yellow fever; 3, scarlet fever; 4, smallpox; 5, diphtheria; 6, typhus fever; 7, typhoid fever; 8, such other contagious, or infectious diseases as the State board of health may from time to time specify.	1, local boards of health; 2, physicians in localities where there are no health authorities.	State board of health	Promptly	The discovery of the presence of these diseases is to be reported and not the cases themselves.

Notifiable diseases and the health authorities to and through which reported—Continued.

	States.	Notifiable diseases.	By whom reported.	To whom reported.	When reported.	Remarks.
12	Hawaii	1, cerebrospinal meningitis; 2, cholera; 3, follicular conjunctivitis; 4, diphtheria; 5, amœbic dysentery; 6, typhoid fever; 7, paratyphoid fever; 8, leprosy; 9, measles; 10, dengue; 11, poliomyelitis; 12, whooping cough; 13, plague; 14, scarlet fever; 15, tetanus; 16, trachoma; 17, tuberculosis; 18, typhus fever; 19, chickenpox; 20, smallpox; 21, yellow fever, or any other infectious or communicable disease or disease dangerous to the public health.	Physicians	Board of health or its nearest agent.	Immediately, in writing	The recovery of cases of tuberculosis is also to be reported.
			Householders, keepers of boarding or lodging houses, masters of vessels, police officers.	Board of health or its nearest agent.	Immediately	Superintendents of institutions are to report cases of tuberculosis coming under their care within 24 hours.
		1, smallpox; 2, scarlet fever; 3, diphtheria; 4, plague; 5, cholera; 6, yellow fever; 7, typhus fever; 8, cerebrospinal meningitis; 9, amœbic dysentery.	Physicians	Board of health or its nearest agent.	Immediately, by telephone or by direct oral communication.	This is in addition to the report in writing.
		Leprosy—known or suspected.	Any and every person	Board of health or its agent	Forthwith	
13	Idaho	1, Asiatic cholera; 2, yellow fever; 3, smallpox; 4, chicken pox; 5, typhus fever; 6, leprosy; 7, bubonic plague; 8, diphtheria; 9, scarlet fever; 10, typhoid fever; 11, measles (including rotheln); 12, whooping cough; 13, cerebro-spinal meningitis; 14, infantile paralysis.	1, physicians; 2, in the absence of an attending physician, the owner or agent of the building in which the case occurs, or the head of the family is to report.	Local board of health	Within 24 hours	Health reports of municipal boards of health must be transmitted to the county board of health quarterly, and the secretary of the county board is to make a quarterly report to the State board of health, containing a summary of contagious and infectious diseases.
		Ophthalmia neonatorum	Midwife, nurse, or other person having charge.	Local health officer or physician.	Within 6 hours	

14	Illinois	1, smallpox; 2, scarlet fever; 3, diphtheria; 4, Asiatic cholera; 5, yellow fever; 6, plague; 7, glanders; 8, anthrax; 9, leprosy.	1, attending physician; or 2, the householder in whose dwelling the case occurs.	Local health authorities	Immediately	
			Local health authorities	Secretary of the State board of health.	The first case immediately and the progress of outbreaks at least once a week.	
		Ophthalmia neonatorum	Midwife or nurse having charge of infant.	Local health officer or physician.	Within 6 hours	
		Disease or illness due or incident to occupation.	Physicians making physical examination of employees for occupation diseases.	State board of health	Immediately	
			Secretary of State board of health.	State department of factory inspection.	Immediately	
15	Indiana	1, yellow fever; 2, smallpox; 3, cholera; 4, diphtheria; 5, membranous croup; 6, scarlet fever; 7, measles; 8, typhus fever; 9, plague; 10, leprosy; 11, tuberculosis (pulmonary); 12, typhoid fever; 13, chicken pox; 14, whooping cough.	1, physicians and midwives; 2, householder or person having case in charge.	1, in cities and towns to the city or town health officer; 2, outside of cities and towns to the county health officer or his deputies.	Immediately	
			Town and city health officers	County health commissioner.	By the 2d of each month forwards the original reports received during the preceding month.	
		1, typhoid fever; 2, scarlet fever; 3, smallpox; 4, diphtheria; 5, membranous croup.	County health commissioners.	State board of health	By the 8th day of each month for the preceding month.	County health commissioners also make a quarterly report of contagious diseases to the State board of health.
		Ophthalmia neonatorum when no physician is in attendance.	Parents or persons in charge of infant.	Local health officer	Within 6 hours	
16	Iowa	1, scarlet fever; 2, diphtheria; 3, smallpox; 4, cholera; 5, leprosy; 6, cerebrospinal meningitis; 7, plague; 8, poliomyelitis.	1, attending physician; or 2, in his absence by the householder of the premises wherein the disease exists.	1, mayor of the city or town; 2, clerk of the township if outside of a municipality.	An immediate report to be made, followed within 24 hours by a written notice of the case.	
			1, mayors of municipalities; 2, clerks of townships.	Secretary of the State board of health.	Within 24 hours, and by the 1st of February for the preceding calendar year.	

Notifiable diseases and the health authorities to and through which reported—Continued.

	States.	Notifiable diseases.	By whom reported.	To whom reported.	When reported.	Remarks.
16	**Iowa—(contd.)**	**Ophthalmia neonatorum**	Midwife, parent, guardian, nurse, or other person having charge of the infant.	Health officer or some legally qualified practitioner.	Within 6 hours.	
17	**Kansas**	1, cholera; 2, smallpox; 3, scarlet fever; 4, diphtheria; 5, cerebrospinal meningitis; or 6, any disease dangerous to the public health.	1, physician; 2, householders to report cases in their families.	Nearest board of health or health officer.		Municipal and county boards of health and health officers having knowledge of any contagious or infectious disease within their jurisdiction are required to communicate without delay the facts to the State board of health.
		Tuberculosis	1, physicians; 2, chief officer having charge for the time being of any hospital, dispensary, asylum, or other similar private or public institution.	1, county health officer; or 2, in cities of the first class to the city health officer.	Within 24 hours.	
18	**Kentucky**	1, cholera; 2, smallpox; 3, yellow fever; 4, scarlet fever; 5, diphtheria; and 6, other epidemic and communicable diseases.	1, physicians to report cases in their practice; 2, heads of families to report cases in their families.	1, county board of health or to some member of the board.	Within 24 hours.	
			County boards of health.	State board of health.	At least once in 3 months.	
19	**Louisiana**	**Diseases of an infectious, contagious, or pestilential nature.**	Physicians.	Local board of health.	Within 24 hours.	
		Smallpox	1, attending physician; or 2, the head of the household or manager of the hotel, lodging house, or camp where the case occurs, when no physician is in attendance.	Health officer having jurisdiction, or in the absence of such health officer, the president of the State board of health.	Immediately.	
		Consumption	Physicians.	Municipal or parish health officer.	Immediately.	
			Parish health officer.	State board of health.	Quarterly.	
		Ophthalmia neonatorum	Nurse, midwife, or other person not a legally qualified practitioner of medicine.	Town or parish health officer.	Within 12 hours.	

		Pneumonia	1, attending physician; or 2, in his absence by the head of the household.	Local health officer	Promptly	
		Dengue	Attending physician	Local health officer	Within 24 hours	
		Yellow fever	Municipal and parish health officers.	President State board of health.	Immediately	
			Local board of health	State board of health	Weekly	
		Quarantinable diseases	State board of health	1, health authorities of surrounding States; 2, Surgeon General of the Public Health and Marine-Hospital Service	Immediately	
20	Maine	1, smallpox; 2, diphtheria; 3, scarlet fever; 4, cholera; 5, typhus fever; 6, typhoid fever; 7, cerebrospinal meningitis; 8, measles; 9, membranous croup; 10, whooping cough.	Householders	1, health officer of the town; or 2, the secretary of the local board of health.	Within 24 hours	
		Tuberculosis	1, physicians; 2, chief officer having charge for the time being of any hospital, dispensary, asylum, sanatorium, or other similar private or public institution.	Secretary State board of health.	Within 48 hours	The State board of health is to keep a register of persons affected with tuberculosis.
		1 smallpox; 2, diphtheria; 3, scarlet fever; 4, typhoid fever; 5, cerebrospinal meningitis; 6, measles; 7, membranous croup; 8, whooping cough; 9, tuberculosis (pulmonary).	Local boards of health	State board of health	Promptly	
		Ophthalmia neonatorum	Midwife, nurse, or person in charge.	Legally qualified practitioner of medicine.	At once	

Notifiable diseases and the health authorities to and through which reported—Continued.

	States.	Notifiable diseases.	By whom reported.	To whom reported.	When reported.	Remarks.
21	Maryland	1, smallpox; 2, diphtheria; 3, membranous croup; 4, scarlet fever; 5, typhoid fever; 6, typhus fever; 7, yellow fever; 8, measles; 9, whooping cough; 10, any other contagious or infectious disease dangerous to the public health.	Physicians	Board of health of the city, town, or county.	Immediately	
		1, pulmonary or laryngeal tuberculosis.	Physicians	Secretary of the State board of health.	Within 7 days	The State board of health is to keep a register of all persons known to be affected with tuberculosis.
			The superintendent or other person in charge or control of any hospital, dispensary, school, reformatory, or other institution deriving the whole or any part of its support from the public funds of the State or of any city, town, or county.	State board of health	Weekly on Monday for the preceding week.	
		1, smallpox; 2, diphtheria; 3, membranous croup; 4, scarlet fever; 5, typhoid fever; 6, typhus fever; 7, measles; 8, mumps; 9, whooping cough; 10, any other infectious or contagious disease dangerous to the public health.	Householder	Board of health of the city or county.	Immediately	
		1, smallpox; 2, cholera; 3, yellow fever; 4, typhus fever; 5, typhoid fever; 6, scarlet fever; 7, leprosy; 8, any other infectious or contagious disease occurring on the premises under their management.	Hotel keepers, keepers of boarding houses and lodging houses, superintendents, managers, or directors of private or public institutions of any kind.	Health officer of the city or town or in the absence of such an officer to the secretary of the State board of health.	Immediately in writing	
		1, smallpox; 2, any other contagious or infectious disease	Boards of health of cities, towns, and counties.	State board of health	Within 24 hours	In practice local boards of health report to the State

		dangerous to the public health.				board of health once a month cases of smallpox, diphtheria, typhoid fever, scarlet fever, measles, whooping cough, and mumps, and other diseases irregularly. Local boards of health are also required to report promptly to the State board of health the existence of any epidemic or unusual sickness.
		Ophthalmia neonatorum	Midwife, nurse, or other person in charge.	Local health officer or a physician.	Immediately	
22	Massachusetts	1, actinomycosis; 2, anterior poliomyelitis, 3, Asiatic cholera. 4, cerebro-spinal meningitis; 5, diphtheria; 6, glanders; 7, leprosy; 8, malignant pustule; 9, measles; 10, ophthalmia neonatorum; 11, scarlet fever; 12, smallpox; 13, tetanus; 14, trachoma; 15, trichinosis; 16, tuberculosis; 17, typhoid fever; 18, typhus fever; 19, varicella; 20, whooping cough; 21, yellow fever.	Householder	Board of health of the city or town (township).	Forthwith	
			Physician	Selectmen or board of health of the town (township).	Immediately	
			Boards of health of cities and towns (townships).	State board of health	Within 24 hours	
		Inflamed eyes in infants under 2 weeks of age.	Nurses, relative, or other attendant.	Board of health of the city or town (township).	Within 6 hours	
23	Michigan	1, pneumonia; 2, tuberculosis; 3, typhoid fever; 4, meningitis; 5, diphtheria; 6, whooping cough; 7, scarlet fever, 8, measles; 9, smallpox; 10, cholera. (See "Remarks.")	Physician	1, health officer of the township, city, or village; 2, householder, hotel keeper, keeper of a boarding house, or tenant within whose house or rooms the cases occur.	Immediately	By regulation the following-named diseases are to be reported for statistical purposes: Tetanus, rabies, cancer, erysipelas, and leprosy.
			Householder, hotel keeper, keeper of a boarding house, or tenant having cases in his family or on his premises.	Local health officer	Immediately	
			Health officers of cities, villages, and townships.	Secretary of the State board of health.	Constantly informed respecting the outbreak.	
		Tuberculosis	1, physicians; 2, chief officer having charge for the time being of any asylum, hospital, dispensary, or other similar private or public institution.	Local health officer	Within 24 hours	

Notifiable diseases and the health authorities to and through which reported—Continued.

	States.	Notifiable diseases.	By whom reported.	To whom reported.	When reported.	Remarks.
23	Michigan (contd.).	Inflamed eyes of infants under 2 weeks of age.	Mid wives, nurses, or other persons in charge of the infant.	Local health officer or a physician.	Within 6 hours.	
		1. Poisoning by lead, phosphorus, arsenic, or mercury, or their compounds.	Physicians.	State board of health.		
		2. Anthrax 3. Compressed-air illness when contracted as a result of the patient's employment.	State board of health.	Commissioner of labor.		
24	Minnesota.	1, smallpox; 2, cerebro-spinal meningitis; 3, anterior poliomyelitis; 4, scarlet fever; 5, diphtheria; 6, measles.	Physicians.	Local health officer.	Immediately.	
		Tuberculosis, typhoid fever.	Physicians.	State board of health.	Within 1 week.	
		1, smallpox; 2, scarlet fever; 3, diphtheria; 4, cerebrospinal meningitis; 5, anterior poliomyelitis; 6, measles; 7, typhoid fever; 8, tuberculosis.	Local health officer.	Secretary of the State board of health.	Immediately.	
		Ophthalmia neonatorum.	Midwife, nurse, parent, or other person having charge of the infant.	Local health officer.	Within 12 hours.	
25	Mississippi.	1, yellow fever; 2, cholera; 3, dengue; 4, smallpox; 5, or other virulent, epidemic, contagious disease.	Physicians.	Secretary of State board of health.	Immediately	
		Tuberculosis, consumption, and other pulmonary diseases.	Physicians.	Secretary of State board of health.	Within 10 days.	
26	Missouri.	1, smallpox; 2, diphtheria; 3, membranous croup; 4, scarlet fever; 5, typhus fever; 6, yellow fever; 7, cholera; 8, plague; 9, leprosy.	County health officer.	Secretary of State board of health.	1, immediately; 2, quarterly.	

27	Montana	1, smallpox; 2, diphtheria; 3, scarlet fever; 4, cholera; 5, plague; 6, yellow fever; 7, Rocky Mountain, spotted, or tick fever; 8, typhus fever; 9, typhoid fever; 10, cerebrospinal meningitis; 11, measles.	1, householders; 2, physicians.	Health officer of the town, city, or county.	Immediately	
			City, town, and county health officers.	Secretary of the State board of health.	On or before the 5th day of each month for the preceding calendar month.	
28	Nebraska	1, Asiatic cholera; 2, yellow fever; 3, smallpox; 4, diphtheria; 5, scarlet fever; 6, measles; 7, typhus fever; 8, ophthalmia neonatorum; 9, typhoid fever; 10, cerebrospinal meningitis; 11, leprosy; 12, whooping cough; 13, chickenpox; 14, tuberculosis; 15, puerperal fever; 16, or any other disease contagious or dangerous to the public health.	1, physicians; 2, where no physician is in attendance the responsibility for the reporting of the case falls upon any person having charge, or the head of the family or any person having the care or custody of any lodging rooms in which cases occur; 3, school-teachers.	1, local board of health; 2, where no local board of health is organized, the report is to be made to the State board of health.	Within 24 hours by the most expedient method.	
			Local board of health	State board of health	From time to time	
29	Nevada					
30	New Hampshire	1, smallpox (diagnosed or suspected); 2, cholera; 3, diphtheria; 4, scarlet fever; 5, or other malignant pestilential disease.	Physicians	1, health officer of the town (township); 2, or in his absence to the selectmen of the town (township).	Immediately	
		1, smallpox; 2, diphtheria; 3, membranous croup; 4, scarlet fever; 5, typhoid fever; 6, measles; 7, or any other malignant communicable disease.	If no physician is in attendance, report to be made by any person who knows or has reason to believe that any member of his family or household (boarder, roomer, or visitor) is affected.	Local board of health	Within 24 hours	
			Local board of health	State board of health	Immediate report of the first appearance of the disease and a weekly report thereafter as long as the disease continues.	
		Tuberculosis	Physicians, and officers in charge of hospitals and institutions.	State board of health	Within 1 week	The recovery of cases is also to be reported.

Notifiable diseases and the health authorities to and through which reported—Continued.

	States.	Notifiable diseases.	By whom reported.	To whom reported.	When reported.	Remarks.
31	New Jersey	1, cholera; 2, yellow fever; 3, typhus fever; 4, leprosy; 5, plague; 6, trichinosis; 7, smallpox; 8, typhoid fever; 9, diphtheria; 10, membranous croup; 11, scarlet fever; 12, poliomyelitis; 13, trachoma; 14, rabies; 15, glanders; 16, anthrax; 17, chicken pox; 18, tuberculosis; 19, malaria.	1, physician; 2, when no physician is in attendance the report is to be made by the house owner or the householder.	Local board of health or, in the absence of such board, the assessor of the township.	Within 12 hours	
			Local board of health or, in the absence of such board, the assessor of the township.	State board of health	At least once a week and daily when required by the State board.	
		Tuberculosis	1, physicians; 2, chief officer having charge for the time being of any hospital, asylum, prison, or other private or public institution.	Local board of health	Within 48 hours	
		1, typhoid fever; 2, dysentery; 3, scarlet fever; 4, diphtheria; 5, tuberculosis.	Physicians are to report cases occurring on dairy premises where milk is produced for sale or distribution or in households of which any member is employed on any dairy premises.	State board of health	Within 12 hours	
		Inflamed eyes in infants under 2 weeks of age.	When no physician is in attendance, the midwife, nurse, attendant, or relative having charge of the infant.	Local board of health	Within 6 hours	
32	New Mexico	1, smallpox; 2, or other contagious or infectious disease dangerous to the public health.	1, physician; 2, householder or other person.	1, county health officer, if within a city, town, or village; 2, justice of the peace of the precinct, if outside of a city.	At once	
33	New York	1, poliomyelitis; 2, anthrax; 3, plague; 4, cancer; 5, cerebrospinal meningitis; 6, cholera; 7, diphtheria; 8, hydrophobia; 9, leprosy; 10, measles;	1, physician; 2, when no physician is in attendance, the report is to be made by the superintendent or other officer of an institution, hospital,	Health officer of the city, village, or town (township).	Immediately	The physician or other person making the report is entitled to the sum of 25 cents therefor.

		11, ophthalmia neonatorum; 12, pellagra; 13, pneumonia; 14, scarlet fever; 15, smallpox; 16, tetanus; 17, tuberculosis (pulmonary or laryngeal); 18, typhoid fever; 19, typhus fever; 20, whooping cough; 21, yellow fever.	or hotel or lodging-house keeper, or other person where the case occurs.			
			Health officers of cities, villages, and towns (townships).	State department of health..	Once a month...	Health officers of villages and towns (townships) are to be paid a sum not to exceed 20 cents for each case reported.
		Poisoning from lead, phosphorus, arsenic, or mercury, or their compounds, or from anthrax, or from compressed-air illness contracted as the result of the nature of the patient's employment.	Physicians..................	Commissioner of labor......		
		Smallpox.........	Local boards of health.... ..	State department of health..	Promptly................	
		1, smallpox; 2, typhus fever; 3, yellow fever, 4, cholera.	Health officers, commissioners of health, or boards of health of cities of the first class (population over 175,000).	State department of health..	Promptly...	
34	North Carolina....	1, smallpox; 2, diphtheria; 3, scarlet fever; 4, typhus fever; 5, yellow fever; 6, cholera; 7, measles; 8, whooping cough; 9, plague.	1, physician; 2, householders..	Quarantine officer or his deputy.	Immediately............	
			Deputy quarantine officer of township.	County quarantine officer...	At once...................	
			Quarantine officers (county and city).	Secretary State board of health.	By 5th of month for preceding month.	
		1, plague; 2, yellow fever; 3, typhus fever; 4, cholera.	Quarantine officers...........	Secretary State board of health.	By telegram within 24 hours.	
35	North Dakota.....	Infectious or contagious diseases.	Physician.	1, local health officer; 2, clerk of the civil township, or, in counties not under township organization, to the county commissioner.	Immediately..	
		Contagious, epidemic, or infectious diseases.	Physician or other person.....	Local board of health........	Immediately............	Physicians are to report to the local board of health not less than twice each week the condition of each person affected and the state of the disease.

Notifiable diseases and the health authorities to and through which reported—Continued.

	States.	Notifiable diseases.	By whom reported.	To whom reported.	When reported.	Remarks.
35	North Dakota (continued).	Contagious, epidemic, or infectious diseases (continued).	1, each keeper of a private house, boarding house, lodging house, inn, or hotel to report cases on his premises; 2, in the absence of a physician it is the duty of parents to report cases occurring in their households; 3, also the oldest person next of kin, the keeper or other proper officer of every workhouse, poorhouse, reform school, jail, prison, hospital, asylum, or other public or charitable institution to report cases among persons under his charge.	Local board of health	Within 24 hours	
		Ophthalmia neonatorum	When no physician is in attendance cases are to be reported by the parents or persons having charge of the infant.	Health officer having jurisdiction.	Within 6 hours in writing.	Physicians and recognized hospitals are not required to report.
		Contagious and infectious diseases.	1, health officers of cities; 2, clerks of organized civil townships; 3, county commissioners in counties not under township organization.	County superintendent of health.	Not later than the 10th day of each month for the preceding month.	
			County superintendent of health.	State superintendent of health.	1, immediately; 2, on or before the 15th of each month for the preceding month.	
			State superintendent of health.	Governor of the State	Dec. 1 of each even-numbered year for preceding 2 years.	

		1, smallpox; 2, scarlet fever; 3, diphtheria; 4, or other infectious or contagious diseases.	Local board of health	State board of health	Immediately	
36	Ohio	1, smallpox; 2, cholera; 3, plague; 4, yellow fever; 5, typhus fever; 6, diphtheria; 7, membranous croup; 8, scarlet fever; 9, typhoid fever; 10, cerebrospinal meningitis; 11, chicken pox; 12, measles; 13, whooping cough; 14, poliomyelitis; 15, any other disease dangerous to the public health; 16, trachoma.	1, physician or other person attending cases; 2, owners or agents of buildings in which cases occur; 3, heads of families in which cases exist.	Health officer		
		1, cholera; 2, plague; 3, cerebrospinal meningitis; 4, chicken pox; 5, diphtheria; 6, measles; 7, membranous croup; 8, scarlet fever; 9, smallpox; 10, typhoid fever; 11, typhus fever; 12, whooping cough; 13, poliomyelitis.	Boards of health of cities, villages, and townships.	State board of health	Semimonthly on 1st and 16th of each month.	
		Ophthalmia in infants under 10 days old.	Midwives, nurses, or relatives	Physician or local health officer.	Within 6 hours	
37	Oklahoma	Infectious and contagious diseases.	Physicians	1, county superintendent of public health if outside city of first class; 2, city superintendent of public health if in city of first class.	The law requires an immediate report. The regulations promulgated by the State commissioner of health require reports monthly on the last day of the month.	
		Tuberculosis	1, physician; 2, chief officer having charge for the time being of any hospital, dispensary, or asylum, or other similar public or private institution.	Health officer for the city, town, or village.	Within 24 hours	
		Infectious and contagious diseases.	City and county superintendents of health.	State commissioner of health.	On the 10th day of each month for the preceding calendar month.	

Notifiable diseases and the health authorities to and through which reported—Continued.

	States.	Notifiable diseases.	By whom reported.	To whom reported.	When reported.	Remarks.
38	Oregon	1, diphtheria; 2, membranous croup; 3, scarlet fever; 4, cholera; 5, typhus fever; 6, typhoid fever; 7, smallpox; 8, measles; 9, cerebrospinal meningitis; 10, ophthalmia neonatorum; 11, infantile paralysis; 12, bubonic plague; 13, leprosy; 14, barber's itch; 15, tuberculosis.	Physicians	County or municipal health officer.	Within 24 hours by the quickest means of communication.	
			Superintendents of State institutions, children's homes, and other institutions of a public nature.	Secretary State board of health.	Not later than the 10th day of each month for the preceding month.	
		1, cholera; 2, yellow fever; 3, smallpox; 4, diphtheria; 5, membranous croup; 6, scarlet fever; 7, typhus fever; 8, typhoid fever; 9, "hubonic" (sic); 10, or any other contagious disease.	Physicians, or in the absence of a physician, the householder.	Health officer having jurisdiction.	In writing within 24 hours, giving the name and residence of the patient.	
		Infectious diseases	County boards of health and city health officers.	Secretaty State board of health.	Not later than the 10th day of each month for the preceding month.	All cases of smallpox or other contagious disease of alarming proportions must be reported at once.
39	Pennsylvania	1, actinomycosis; 2, anthrax; 3, plague; 4, cerebrospinal meningitis; 5, chicken pox; 6, cholera; 7, diphtheria; 8, dysentery (epidemic); 9, erysipelas; 10, German measles; 11, glanders; 12, hookworm disease; 13, leprosy; 14, malarial fever; 15, measles; 16, mumps; 17, pellagra; 18, pneumonia; 19, poliomyelitis; 20, puerperal fever; 21, rabies; 22, relapsing fever; 23, scarlet fever; 24, smallpox; 25, tetanus; 26, trachoma; 27, trichiniasis; 28, tuberculosis; 29, typhoid fever; 30, typhus fever; 31, whooping cough; 32, yellow fever.	Physicians	1, If in a township of the first class, borough, or city, report is made to the health authorities of the township, borough, or city; 2, if in a township of the second class, or in a city, borough, or township of the first class not having a board of health or body acting as such, the report is made to the State department of health.		
			1, health authorities of cities, boroughs, and townships of the first class; 2, superintendent and other persons in charge of asylums, hospitals, or other institutions	State department of health	At the end of each week and for the fraction of the week occurring at the end of each month.	

			located in townships of the second class.			
		Inflamed eyes in infants under 2 weeks of age.	Midwife, nurse, or other person having care of infant.	Health officer or legally qualified practitioner.	Within 6 hours	
40	**Porto Rico**	1, typhus fever; 2, typhoid fever; 3, smallpox; 4, varioloid; 5, scarlet fever; 6, diphtheria; 7, yellow fever; 8, cholera; 9, plague; 10, beriberi; 11, epidemic dysentery; 12, cerebrospinal meningitis; 13, whooping cough; 14, mumps; 15, malaria; 16, tuberculosis; 17, glanders; 18, leprosy; 19, cutaneous syphilis; 20, uncinariasis.	Physicians	Nearest health officer		
		Infectious or contagious diseases.	Physicians	Local health officer		
			Health officers	Director of sanitation	Immediately.	
41	**Rhode Island**	1, smallpox; 2, or any other contagious or infectious distemper.	Householder to report cases in his house.	Town council	Immediately.	
		Smallpox	Physicians, householders, or other persons to report any cases known.	1, town clerk; 2, if in cities, the superintendent of health.	Immediately.	
		Tuberculosis (pulmonary or laryngeal).	Physicians	Secretary of the State board of health.	Within 7 days	The State board of health is to keep a register of all persons known to be affected with pulmonary or laryngeal tuberculosis.
			Superintendent or other person in charge or control of any hospital, school, reformatory, or other institution deriving the whole or any part of its support from the public funds of the State.	Secretary of the State board of health.	Cases to be reported each week.	
		1, Poliomyelitis; 2, tuberculous meningitis; 3, cerebrospinal meningitis.	Physicians	Secretary State board of health.	Immediately	
		Ophthalmia neonatorum	Midwife, nurse, or person having charge of the infant.	Health officer or some qualified practitioner of medicine.	Within 6 hours	

Notifiable diseases and the health authorities to and through which reported—Continued.

States.	Notifiable diseases.	By whom reported.	To whom reported.	When reported.	Remarks.
42 **South Carolina**....	1, tuberculosis; 2, typhoid fever; 3, diphtheria; 4, scarlet fever; 5, smallpox; 6, measles; 7, whooping cough; 8, cerebrospinal meningitis; 9, leprosy; 10, poliomyelitis.	Physicians..................	1, secretary of local board of health in incorporated cities and towns; 2, secretary State board of health if outside of an incorporated city or town.	Within 24 hours........	
		Secretaries of local boards of health.	Secretary State board of health.	Not later than 5th day of each month for the preceding month.	
	Ophthalmia neonatorum......	Nurses, midwives, or persons in charge.	Local board of health.......	At once..................	This applies only to towns and cities having over 1,000 inhabitants.
43 **South Dakota**.....	1, smallpox; 2, scarlet fever; 3, diphtheria; 4, measles; 5, cholera; 6, or any other disease dangerous to the public health.	Physician..................	Superintendent of county board of health.	Immediately.............	
	Poliomyelitis.................	Physician or head of family...	County board of health.....	Immediately.............	
	1, smallpox; 2, scarlet fever; 3, diphtheria; 4, cholera; 5, or any other disease dangerous to the public health.	Householder to report cases in his family or in persons temporarily residing with him.	Health officer having jurisdiction.	Immediately.............	
	Contagious and infectious diseases.	City and town health officers..	County superintendent of health.	Monthly..................	
	Contagious or infectious diseases.	Superintendents of county boards of health.	Superintendent of State board of health.	Immediately.............	
44 **Tennessee**.........	1, smallpox; 2, yellow fever; 3, cholera; 4, plague; 5, typhus fever; 6, diphtheria; 7, membranous croup; 8, scarlet fever; 9, or other communicable disease (except venereal disease); 10, poliomyelitis.	1, head of the household or other person in the household; 2, physicians.	Municipal or county health authorities.	Immediately.............	

		Ophthalmia neonatorum......	Midwife, nurse, or other person having care of infant.	Health officer or physician..	Immediately..............	
		1, smallpox; 2, cholera; 3, yellow fever; 4, scarlet fever; 5, diphtheria; 6, or other disease dangerous to the public health.	Municipal and county boards of health.	State board of health.......	Immediately..............	
		All communicable diseases.....	Municipal and county boards of health.	State board of health.......	On the 1st of each month for the preceding calendar month.	
45	Texas............	1, Asiatic cholera; 2, plague; 3, typhus fever; 4, yellow fever; 5, smallpox; 6, scarlet fever; 7, diphtheria; 8, cerebrospinal meningitis; 9, dengue; 10, typhoid fever; 11, epidemic dysentery; 12, trachoma; 13, tuberculosis; 14, anthrax.	Physicians....................	Local health authority......	Immediately in writing or by telephone.	
			Hotel proprietors, keepers of boarding houses or inns, householders, and heads of families whenever notice has not been given by the physician in attendance.	Local health authority......	Within 12 hours..........	
			City and county health authorities.	President State board of health.	By the 5th of each month for the preceding calendar month.	
		Disease pestilential in character.	Physicians....................	President State board of health.	By telegraph or telephone at State expense.	
		Ophthalmia neonatorum	Nurse, midwife, or other person not a legally qualified practitioner of medicine.	Local health authority, or in his absence to any reputable physician.	Within 12 hours..........	
46	Utah............	1, scarlet fever; 2, diphtheria; 3, whooping cough; 4, smallpox; 5, typhoid fever; 6, measles; 7, tuberculosis; 8, cholera; 9, rubella; 10, chickenpox; 11, typhus fever; 12, plague; 13, cerebrospinal meningitis; 14, poliomyelitis; 15, leprosy; 16, pneumonia.	Physicians and other persons caring for the sick.	Local board of health.......	Immediately..............	

Notifiable diseases and the health authorities to and through which reported—Continued.

	States.	Notifiable diseases.	By whom reported.	To whom reported.	When reported.	Remarks.
46	Utah (cont'd)	Any contagious or infectious disease.	Physicians or other persons having knowledge of actual or suspected cases.	Local board of health.......	Immediately..........	
		Venereal diseases...........	Physicians and superintendents or managers of hospitals or public institutions.	Local board of health......	Immediately...........	Name of person affected not to be included in the report.
		Ophthalmia neonatorum. ..	Physicians and midwives.....	Local board of health....	Within 6 hours...	
			Local health officer...........	State board of health... ..	Immediately by telephone or telegraph.	
		1, scarlet fever; 2, smallpox; 3, diphtheria; 4, membranous croup; 5, typhoid fever; 6, whooping cough; 7, measles; 8, chicken pox; 9, pneumonia; 10, tuberculosis.	Local boards of health or health officers.	State board of health........	On or before the 5th day of each month for the preceding month.	
47	Vermont..........	Communicable diseases dangerous to the public health.	Physicians.....................	Local health officer..........	Immediately..........	
		Infectious or contagious disease dangerous to the public health.	Head of family to report cases in his home.	Local health officer..........	Immediately........... ..	
		Tuberculosis..................	Physicians.....................	Secretary State board of health.	....	
		Ophthalmia neonatorum.	Nurse, relative, or other person having charge of infant.	Local health officer..........	Within 6 hours in writing.	
		1, smallpox; 2, Asiatic cholera; 3, typhus fever; 4, yellow fever; 5, and contagious or infectious diseases dangerous to the public health.	Local health officer...........	Secretary of the State board of health.	Immediately..............	When a communicable disease prevails or becomes epidemic, the local health officer is to make weekly reports to the State board.

48	Virginia	1, smallpox; 2, Asiatic cholera; 3, plague; 4, diphtheria; 5 scarlet fever; 6, yellow fever.	Physician	Secretary of the local board of health	Immediately	
		1, typhoid fever; 2, measles; 3, chicken pox; 4, tuberculosis; 5, hookworm disease.	Physician	Secretary of the local board of health.	Once each month	The State commissioner of health advised Oct. 31, 1911, that poliomyelitis had been made notifiable during the early part of 1911.
		Any infectious, contagious communicable, or dangerous disease.	Physician	Executive officer of the board of health of the county, town, or city.		
			Local health authorities of the cities, towns, and counties.	State board of health	Weekly	
		1, smallpox; 2, yellow fever; 3, cholera; 4, typhus fever; 5, plague.	Local health authorities of the cities, towns, and counties.	State board of health	Immediately	
49	Washington	1, anterior poliomyelitis; 2, Asiatic cholera; 3, beriberi; 4, chicken pox; 5, diphtheria (or membranous croup); 6, epidemic cerebrospinal meningitis; 7, favus; 8, leprosy; 9, measles; 10, pellagra; 11, plague; 12, scarlet fever; 13, smallpox; 14, trachoma; 15, tuberculosis (pulmonary and abdominal); 16, typhoid fever; 17, typhus fever; 18, uncinariasis; 19, whooping cough; 20, yellow fever; 21, so-called cedar, Cuban, dobe, Egyptian, Japanese, kangaroo, Manila or Philippine itch.	Physicians	Local health officer	Within 24 hours	
			City health officers, except those of cities of the first class (cities having over 20,000 inhabitants).	Every new outbreak to the county health officer and to the State commissioner of health.	Immediately	
				County health officer	Weekly	
			1, county health officers; 2, health officer of cities of the first class.	State commissioner of health.	Monthly by the 5th day of the month for the preceding month.	
		1. Smallpox	Physicians, or in their absence heads of families or householders.	Local health officer	Immediately	
		Obscure, eruptive disease of the nature of which he is in doubt.	Physicians	Local health officer	Immediately	
		1. Acute disease accompanied by an eruption of the skin.	Householder	Local health officer or the family physician.	Immediately	

Notifiable diseases and the health authorities to and through which reported—Continued.

	States.	Notifiable diseases.	By whom reported.	To whom reported.	When reported.	Remarks.
49	Washington (con.).	1, Asiatic cholera; 2, chicken pox in adults; 3, diphtheria; 4, plague; 5, scarlet fever; 6, smallpox; 7, yellow fever; 8, typhus fever.	1, county health officer; 2, health officers of cities of the first class.	State commissioner of health.	1, first case immediately; 2, after investigation report fully regarding outbreak.	
50	West Virginia	1, cholera; 2, smallpox; 3, scarlet fever; 4, diphtheria; 5, tuberculosis; 6, and other endemic, epidemic, infectious, or contagious diseases.	Physicians (where there is a local board of health).		Promptly	
			City and county board of health.	State board of health	At least once in every 3 months.	
51	Wisconsin	1, Asiatic cholera; 2, yellow fever; 3, smallpox; 4, typhus fever; 5, leprosy; 6, plague; 7, diphtheria; 8, scarlet fever; 9, typhoid fever; 10, measles; 11, whooping cough; 12, cerebro-spinal meningitis; 13, poliomyelitis.	1, physicians; 2, in absence of an attending physician the report is to be made by the head of the family or the person in charge of the house or building.	Local board of health	Immediately	
			Local health officer	State board of health	To make report upon the appearance of any of the enumerated diseases.	
		1, chicken pox; 2, erysipelas	Physicians	Local board of health		
		Tuberculosis	Physicians or person or owner, or agent, manager, principal, or superintendent of every public or private institution, or dispensary, hotel, boarding or lodging house.	Local department of health (town, city, or village).	Within 1 week	
		Inflamed eyes of infants under 2 weeks of age.	Nurse, parents, or other attendant.	Local board of health	Within 6 hours	
52	Wyoming	Communicable diseases	1, physician; 2, householder to report cases in his family or household.	Local board of health or health officer.	Immediately	

1, smallpox; 2, cholera; 3, scarlet fever; 4, diphtheria; 5, or contagious or infectious disease a menace to the public health.	Physician.	1, secretary State board of health; 2, county health officer.	Immediately by telegram or telephone, or in the most expeditious manner, the telegram to be paid for by the State.
1, smallpox; 2, cholera; 3, typhoid fever; 4, scarlet fever; 5, diphtheria; 6, or other epidemic or contagious or infectious disease.	County health officer.	Secretary of State board of health.	Immediately.
Typhoid fever on premises from which milk is sold.	State health officer.	State board of health.	At once.

Provisions made for health authorities by State and Territorial laws and regulations.

	Name of State.	State organization.	Counties.	Townships.	Cities.	Remarks.
1	Alabama..........	The State medical association is the State board of health. It elects a State health officer.	The county medical society constitutes a board of health for the county and for all municipalities therein. It elects a health officer for the county.	....	Health officer elected by county board of health for each incorporated city and town.	
2	Alaska..	....	....	....	....	
3	Arizona....	Board of health and superintendent of public health.	Board of health and superintendent of public health with jurisdiction outside of cities possessing a board of health.	....	Board of health and health officer in incorporated cities.	
4	Arkansas..........	Board of health..............	The county judges may appoint boards of health for their respective counties.	....	In cities of the first and second class the city council may establish a board of health with jurisdiction extending 1 mile beyond the city limits.	
5	California..........	Board of health..............	In each county the board of supervisors appoints a health officer.	....	It is the duty of the board of trustees or council of every incorporated town and city to establish a board of health. Unincorporated towns having 500 or more inhabitants have health officers appointed by the county board of supervisors.	
6	Colorado..........	Board of health..............	The board of county commissioners constitutes a board of health with jurisdiction outside of municipalities. This board appoints a health officer.	....	The mayor and council or trustees of each incorporated city and town constitute a board of health for the city or town and appoint a health officer.	
7	Connecticut.......	Board of health..............	The judges of the superior court appoint an attorney at law to be health officer for each county. He is not a local health officer, how-	The county health officer appoints a health officer for each town (township), except in towns containing a municipality,	The mayor of every city and the warden of every borough appoints a health officer for the city or borough, except in cities the char-	

			ever, as each town (township) has a local health officer.	the limits of which are coterminus with the town limits. In towns containing a city or borough, the limits of which are not coterminus with those of the town, the town health officer has jurisdiction only outside of the limits of the city or borough.	ters of which make other provision for such appointment.	
8	Delaware	Board of health	The governor appoints 3 physicians in each county to be health officers of the county.		It is the duty of the common council in cities and of the commissioners in incorporated towns to appoint a board of health for the city or town.	
9	District of Columbia.	Health officer appointed by the District Commissioners.				
10	Florida	1, State board of health; 2, State health officer.	The State health officer had appointed 41 agents in 39 counties (June 12, 1911).		Charters granted to cities by the legislature usually make provision for city health officers.	
11	Georgia	State board of health	The authorities of each county are authorized to establish a board of health and appoint a health officer, the board to have jurisdiction outside of incorporated municipalities.		The council of each incorporated city and town is authorized to establish a board of health and appoint a health officer.	
12	Hawaii	Territorial board of health				Board may appoint agents in such localities as it may deem necessary.
13	Idaho	State board of health	Board of health		The county boards of health are to insist on the organization of municipal boards of health in the incorporated towns and villages.	

Provisions made for health authorities by State and Territorial laws and regulations—Continued.

	Name of State.	State organization.	Counties.	Townships.	Cities.	Remarks.
14	Illinois	State board of health	The board of county commissioners in counties not under township organization constitute a board of health, with jurisdiction outside the limits of incorporated municipalities and with power to appoint a health officer for the county.	In counties under township organization the supervisor, assessor, and town clerk of each township constitute a board of health for the township, with jurisdiction outside the limits of incorporated municipalities and with power to appoint a health officer.	The city council in cities and the president and board of trustees in villages have power to appoint a board of health for their respective cities and villages, except in cities incorporated under special acts making other provision.	The city councils and boards of trustees in cities and villages have jurisdiction extending for one-half mile beyond the city or village limits for the purpose of enforcing health and quarantine ordinances and regulations.
15	Indiana	1, State board of health; 2, State health commissioner.	County health commissioner		Board of health in all incorporated cities, except that in counties having a population of less than 30,000 the county health commissioner may by agreement act also as city health officer in lieu of a city board of health. In incorporated towns the board of town trustees appoints a health officer.	
16	Iowa	State board of health		The trustees of each township constitute a board of health.	The mayor and council of each municipality constitute a board of health. They appoint a health officer.	The State is divided into 8 health districts.
17	Kansas	State board of health	The county commissioners in each county constitute a county board of health and elect a health officer.			
18	Kentucky	State board of health	Board of health		Cities having a population of over 2,500 have a board of health and a health officer.	
19	Louisiana	State board of health	The police jury of each parish is required to appoint a parish board of health and health officer.		Board of health	

20	Maine	State board of health		Board of health in each organized town (township).	Board of health	
21	Maryland	State board of health	The board of county commissioners constitutes a local board of health in each county, with jurisdiction throughout the county, except in cities having charters inconsistent with such extension of jurisdiction. The county board appoints a county health officer.			
22	Massachusetts	State board of health		Board of health	Board of health unless other provision is made in the city charter.	The State is divided into 14 health districts, with a State inspector of health in each district.
23	Michigan	State board of health		The township board constitutes a board of health and appoints a health officer.	The mayor and aldermen of each incorporated city and the president and council or trustees of each incorporated village in which no board of health is organized under its charter constitute a board of health for the city or village.	
24	Minnesota	State board of health	Board of health, with jurisdiction over all unorganized towns.	Every township board of supervisors constitutes a board of health for the township and has jurisdiction outside of cities and villages provided with an organized board of health. The board appoints a health officer.	Villages may and cities must provide for the establishment of a board of health and the appointment of a health officer.	
25	Mississippi	1, State board of health; 2, the State medical association and all other societies and associations of the State in affiliation with the purposes of its organization are constituted the Mississippi Department of Public Health. Any licensed practitioner may, on application, become a member of the department.	1, The State board of health appoints a health officer in each county, except in interior counties not wanting a health officer; 2, it is the duty of the bureau of vital statistics of the State department to appoint a county board of health in each county.		Cities may establish a board of health.	

Provisions made for health authorities by State and Territorial laws and regulations—Continued.

	Name of States.	State organization.	Counties.	Townships.	Cities.	Remarks.
26	Missouri	State board of health	County board of health, with jurisdiction outside of incorporated cities and towns.		St. Louis: Board of health and health commissioner. Cities of first class—board of health and health department. (Cities of the first class are those having a population of from 75,000 to 150,000.)	
27	Montana	1, State board of health; 2, State health officer.	1, county board of health; 2, County health officer.		1, incorporated cities and towns have a board of health; 2, towns having less than 5,000 inhabitants may place themselves under the county board of health.	
28	Nebraska	State board of health	County board of health, with jurisdiction throughout the county, except in cities and villages having power to establish boards of health.		1, cities having a population of over 100,000 have a health commissioner; 2, other cities have power to create a board of health.	
29	Nevada	State board of health	County board of health, consisting of the county physician, sheriff, and the board of county commissioners.		In incorporated cities and towns the city council has power to create a board of health. The board of county commissioners has the power to establish and maintain a board of health in any town or city.	
30	New Hampshire	State board of health		Board of health	The city council constitutes a board of health in cities.	
31	New Jersey	State board of health		Board of health	Every city, borough, and town is required to have a board of health.	
32	New Mexico	Territorial board of health	County health officer		The mayor and council, trustees, or other governing bodies of incorporated cities and towns constitute a board of health.	

33	New York........	State department of health, at the head of which is a commissioner of health.	....	Board of health and health officer, with jurisdiction outside the limits of incorporated cities and villages having organized boards of health.	1, cities of the first class (population over 175,000) have a commissioner of health; 2, cities of the second class (population between 50,000 and 175,000), the commissioner of public safety appoints a health officer; 3, cities of the third class (population less than 50,000), board of health and health officer; 4, villages have a board of health and a health officer.	
34	North Carolina....	State board of health and State health officer.	1, board of health; 2, superintendent of health; 3, quarantine officer.	The county quarantine officer may appoint a deputy quarantine officer in each township.	City and town authorities may elect municipal health officers.	
35	North Dakota.....	State board of health..........	1, county superintendent of health; 2, county board of health with jurisdiction outside the limits of cities having a city board of health. The county board is under the supervisory control of the State board.	The supervisors of each township constitute a board of health.	1, board of health and health officer in each incorporated city; 2, the trustees of each incorporated village constitute a board of health for the village.	
36	Ohio..............	State board of health..........	....	The trustees of each township constitute a board of health with jurisdiction outside the limits of cities. They appoint a health officer.	1, cities have a board of health and health officer; 2, villages may have a board of health and health officer or only health officer.	
37	Oklahoma.......	State board of health "in charge of * * * the State commissioner of health."	The State commissioner of health appoints in each county, a county superintendent of public health.	The board of directors of each township constitute a board of health, under the supervision of the county superintendent of public health.	1, in incorporated towns the town board of directors constitutes a town board of health, under the supervision of the county superintendent; 2, in cities of the first class (over 2,000 population) the mayor and common council constitute a board of health and are authorized to appoint a city superintendent of public health.	

Provisions made for health authorities by State and Territorial laws and regulations—Continued.

	Name of State.	State organization.	Counties.	Townships.	Cities.	Remarks.
38	Oregon	State board of health and State health officer.	Board of health and health officer.		Board of health and health officer.	
39	Pennsylvania	Department of health consisting of a commissioner of health and an advisory board.	The State department of health has appointed a physician in each county to act as a representative of the department.	1, In townships of the first class (population of at least 300 to the square mile) the township commissioners appoint a board of health which elects a health officer; 2, in townships in which there is no organized board of health the State department appoints a local health officer and pays his salary.	1, cities of the first class (population over 1,000,000) have a board of health, the executive officer of which is the director of public health and charities; 2, cities of the second class (population 100,000 to 1,000,000) have a bureau of health under the control of the department of public safety; 3, cities of the third class (population under 100,000) may by ordinance create a board of health; 4, boroughs (incorporated villages with over 300 inhabitants) have a board of health.	The commissioner of health is authorized to apportion the State into 10 districts and to appoint a physician in each district to be health officer and to appoint such assistants to the district health officers as may be necessary.
40	Porto Rico	1, director of health, charities, and corrections; 2, insular board of health; 3, director of sanitation.				The island is divided into four sanitary districts with an inspector in charge of each. Each sanitary district is divided into sanitary zones. Each zone has a board of health and is in charge of a health officer.
41	Rhode Island	State board of health and commissioner of public health.		In each town (township) the town council or board of aldermen constitutes a board of health and appoints a health officer.	City councils may appoint boards of health.	
42	South Carolina	1, State board of health, consisting of the State medical association and the attorney and comptroller generals; 2, executive committee recommended by State medical			It is the duty of the mayor or intendent of every incorporated city, town, or village to appoint a board of health. The board of health elects a health officer. It is	The executive committee is authorized to divide the State into health districts, and in districts in which there are no boards of health to ap-

		association and appointed by the governor; 3, State health officer appointed by the governor.			the duty of the State board to appoint boards of health in all unincorporated towns and villages with a population of more than 100.	point subboards of health.
43	South Dakota	State board of health	Board of health consisting of the State's attorney of the county and 2 physicians appointed by the State board of health, one of whom is superintendent of the county board and the other vice president.		City councils have the power to appoint boards of health for their respective cities.	
44	Tennessee	State board of health	The county judge, court clerk, and health officer or jail physician constitute a county board of health. It is the duty of the county court in counties having jails to appoint a jail physician or health officer.		Municipalities having 5,000 or more inhabitants are required to organize boards of health.	Boards of health of cities and towns have jurisdiction extending to 1 mile beyond the corporation limits.
45	Texas	State board of health and State health officer. The latter is president and executive officer of the board.	County health officer appointed by the commissioner's court.		It is the duty of the authorities of each incorporated city and town to elect a city health officer.	
46	Utah	State board of health	The county outside of incorporated municipalities is divided into sanitary districts with a health officer in each. The district health officers, together with the county commissioners constitute a county board of health.		It is the duty of the city authorities of every incorporated city and town to establish a board of health.	
47	Vermont	State board of health		The State board of health appoints a health officer for each town (township). The health officer with the selectmen of the town or board of aldermen of the city constitutes a local board of health.	Board of aldermen and health officer constitute board of health.	

Provisions made for health authorities by State and Territorial laws and regulations—Continued.

	Name of State.	State organization.	Counties.	Townships.	Cities.	Remarks
48	Virginia	1, State board of health; 2, health commissioner.	The State board of health appoints 3 physicians in each county, who with the chairman of the board of supervisors constitute a county board of health.		The State board of health appoints 3 physicians in each incorporated city and town who with the mayor constitute a city or town board of health (except in cities having charters providing for the creation of a board of health). Each board elects one of its medical members health officer.	
49	Washington	1, State board of health; 2, State commissioner of health.	The board of county commissioners constitutes a county board of health and appoints a health officer. The board has jurisdiction outside of cities of the first class (cities having over 20,000 inhabitants).		Health officers in all incorporated cities and towns.	
50	West Virginia	State board of health	1, county board of health (of which 3 of the 5 members are appointed by the State board of health); 2, county health officer with jurisdiction outside of incorporated cities and towns.		Incorporated cities, towns, and villages have boards of health and health officers independent of the county board and auxiliary to the State board. Of the above local boards of health the State board appoints 3 of the 5 members.	
51	Wisconsin	State board of health		The town (township) board constitutes a board of health and elects a health officer.	The village board or common council constitute a board of health in cities and villages and appoint a health officer.	
52	Wyoming	State board of health	The State board of health appoints a physician in each county to be county health officer.			

APPENDIX.

STATE AND TERRITORIAL LAWS WHICH REQUIRE THE REPORTING OF CASES OF SICKNESS.

Compiled in the bureau from the statutes of the several States and Territories, as found in the Law Library of Congress, and from copies of recent laws transmitted by special request by the respective State health authorities.

ALABAMA.

[Code of 1907.]

SEC. 703. It shall be the duty of county boards of health:

(a) To * * * enforce the law for the collection of vital and mortuary statistics.

* * * * * * *

SEC. 706. It shall be the duty of the health officer of a county:

(a) To keep * * * also, a book to be styled "The Register of Infectious Diseases," in which book he shall register, so far as reported to him, the name, age, sex, color, race, occupation, and place of residence, together with such other details as may be required by said regulations, of all persons who may be attacked by any of the diseases enumerated in section seven hundred and sixteen of this code; * * *.

* * * * * * *

(h) To make to the State health officer prompt report of the presence in the county, so far as reported to him, or has come to his knowledge, of any of the diseases enumerated in section seven hundred and sixteen of this code, furnishing such information and at such intervals as the State health officer may require.

* * * * * * *

SEC. 710. It shall be the duty of the health officer of a municipality:

(a) To keep, under regulations prescribed by the State board of health * * * a book to be styled "The Register of Infectious Diseases," in which he shall register, so far as reported to him, the name, age, sex, color, race, occupation, and place of residence, together with such other details as may be required by said regulations, of all persons who may be attacked by any of the diseases enumerated in section seven hundred and sixteen of this code; * * *.

* * * * * * *

(g) To make to the mayor and council of the municipality, to the committee of public health of the county board of health, and to the State health officer prompt reports of the presence in the municipality of any of the diseases enumerated in section seven hundred and sixteen of this code, furnishing such information and at such intervals as said authorities may require; * * *.

* * * * * * *

SEC. 714. Every physician who is called to a case of any of the diseases named in section seven hundred and sixteen of the code shall, as soon thereafter as can be done, make a report thereof to the county, city, or town health officer in whose jurisdiction the case is located, specifying the name of the patient, the locality of the patient, the character of the disease, together with such other details as will furnish adequate information of the conditions and surroundings.

SEC. 715. Whenever a disease appears in a county, incorporated city, or town, suspected by any physician, or midwife, or by any person on whose premises such sick person is, of being one of those enumerated in the next succeeding section, such physician, or midwife, or such person, shall report his or her suspician to the health officer having jurisdiction over the locality where such case appears, * * *.

SEC. 716. Should the disease prove to be leprosy, cholera, typhus fever, cerebrospinal meningitis, or spotted fever, yellow fever, scarlet fever, bubonic plague, hydrophobia, glanders, smallpox, diphtheria, pulmonary tuberculosis, typhoid fever, Chagres fever, beriberi, or of other nature believed to be grave and at the same time contagious, infectious, or pestilential in character, or if the disease be known to be either one of those just enumerated and be so reported, the health officer of the county, city, or town shall promptly notify in writing the probate judge and commissioners or board of revenue of the county, the mayor or intendant, and the council of the city or town, according to the location of the disease, of the presence and extent of prevalence of the disease, * * *.

* * * * * * *

SEC. 7049 (as amended by ch. 446, Acts of 1911). Any head of a family, or other person, upon whose premises a case of infectious or pestilential disease occurs, which is not under the charge of a physician, who refuses or willfully fails to report the same as promptly as can be done, to the health officer, county or municipal, in whose jurisdiction the case is must, on conviction, be fined not less than five nor more than twenty-five dollars.

* * * * * * *

SEC. 7052. (as amended by ch. 446, Acts of 1911.) Any physician being called upon to treat a case of infectious or pestilential disease or to whose knowledge the existence of such case comes, who refuses or willfully fails to make to the health officer, county or municipal, in whose jurisdiction the case is located, a full and prompt report thereof, specifying the character of the disease, the name and locality of the patient, together with such other details as may be required by the state board of health, must, on conviction, be fined not less than ten nor more than fifty dollars.

ARIZONA.

[Acts of 1903, ch. 65.]

SEC. 7. * * * The county superintendent of health shall keep a record of all the proceedings of the board and of his official acts, and he shall, at the end of every month, make a full report in writing to the superintendent of public health of the proceedings of the county board of health and of his official acts, and shall, whenever the health of persons is in danger, and when any contagious and infectious disease occurs in his county among persons, immediately report the same to the superintendent of public health.

* * * * * * *

SEC. 24. Whenever it shall come to the knowledge of any physician or other person that a contagious, epidemic, or infectious disease exists within the jurisdiction of any local board he shall immediately report to such board in writing the name and place of residence, if known, of every person afflicted with such disease, and if he is the attending physician of such person he shall report not less than twice in each week the condition of each person so afflicted and the state of such disease.

* * * * * * *

SEC. 26. Each keeper of any private house, boarding house, lodging house, inn or hotel shall report, in writing, to the local board of health within whose jurisdiction the same may occur, each case of contagious, infectious, or epidemic disease which may occur in his house, inn, or hotel. Such report shall be made within twenty-four hours after the existence of such disease shall have become known to such person and shall state the name of each person afflicted with such disease and the nature thereof.

* * * * * *

SEC. 31. It shall be the duty of each local board of health when it shall come to its knowledge that a case of smallpox, scarlet fever, diphtheria, or other infectious or contagious disease exists within its jurisdiction immediately to examine into the facts of the case * * * and shall immediately notify the Territorial board of health of the existence and nature of such disease and of the measures adopted hy it with reference thereto.

ARKANSAS.

[Digest of Statutes, 1904. (Kirby.)]

SEC. 540. It shall be the duty of the State board of health to have general supervision of the State system of * * * the registration of prevalent diseases, said board shall prepare the necessary methods and forms for obtaining and preserving such records and to insure the faithful registration of the same in the several counties. * * * The secretary of said State board of health shall he the superintendent of registration of vital statistics of the State. * * *

CALIFORNIA.

[Political Code, 1909. (Deering.)]

SEC. 2979a (as amended hy sec. 1, ch. 250, Laws of 1911). It is the duty of each coroner and of every county, city and county, city or town health officer, and every memher of the local board of health knowing or having reason to helieve that any case of cholera, plague, yellow fever, leprosy, diphtheria, scarlet fever, smallpox, typhus fever, typhoid fever, anthrax, glanders, epidemic cerehro-spinal meningitis, tuberculosis, pneumonia, dysentery, erysipelas, uncinariasis or hookworm, trachoma, dengue, tetanus, measles, German measles, chickenpox, whooping cough, mumps, pellagra, heriberi, syphilis, gonococcus infection, rahies, poliomyelitis, or any other contagious or infectious disease exists, or has recently existed, within the city, county, city and county, town or township of which he is such officer, * * * to report at once in writing such cases to the secretary of the State board of health at Sacramento.

It is also the duty of every attending or consulting physician, nurse, or other person having charge of or caring for any person afflicted with any of said contagious diseases to report at once in writing to the local board of health or local health officer the nature of the disease, the name of the person afflicted, and the place of his or her confinement; provided, however, that syphilis and gonococcus infection shall he reported by office number only.

* * * * * * *

SEC. 2984. * * * It shall be the duty of such board of health or chief executive health officer to report in writing to the State board of health on or hefore the fifth day of each month all infectious, contagious, and communicahle diseases in man or heast which shall come to their or his knowledge upon hlanks furnished by the State board of health. Said board of health or chief executive health officer, where there is no board of health, in cases of local epidemic of disease shall report to the State board of health all facts concerning the disease. * * *

* * * * * * *

SEC. 3061. * * * Every local board of health established in this State must:

* * * * * * *

Second. Report to the secretary of the State board of health, at Sacramento, at such times as the State board of health may require:

* * * * * * *

(c) The presence of epidemic or other dangerous, contagious, or infectious disease. * * *

[Acts of 1907, ch. 492.]

SEC. 11. It shall bo the duty of every county, city and county, municipal, town, or other health officer or inspector to enforce diligently within the county, city and

county municipality, town or district of which he is such health officer all State laws pertaining to health and sanitary matters; and all orders, rules, and regulations concerning health, * * * prescribed or directed by the State board of health, and all local ordinances, resolutions, orders, and regulations concerning health of the board of supervisors, which shall not be in conflict with the general laws or the orders, rules, and regulations of the State board of health.

Said health officers shall report to the State board of health all violations of the State health laws and all violations of the State laws relating to registration of births, marriages, and deaths which shall come to their knowledge.

Every county health officer and every city and county, city, or town board of health, or chief executive health officer thereof, shall report in writing to the State board of health regularly on or before the fifth day of each month, and also whenever requested by the State board of health or its secretary, all infectious, contagious, and communicable diseases in man or beast which shall come to his knowledge upon blanks furnished by the State board of health; and he shall, in cases of local epidemic of disease, report at such times as shall be requested by the State board of health, or its secretary, all facts concerning the disease. * * *

* * * * * * *

Sec. 13 (as amended by sec. 3, ch. 339, Laws of 1911). The following rules and requirements shall be strictly observed in all cases of quarantine, subject, however, to such changes and modifications as the State board of health or its secretary may otherwise require and direct.

Rule 1.— * * * Said health boards or officers must, within twenty-four hours after quarantine, report fully, in writing, to the secretary of the State board of health all of such cases quarantined: *Provided, however,* That said health officers shall immediately report by telegraph to said secretary of the State board of health every case discovered or known of plague, Asiatic cholera, yellow fever, or typhus fever, and after investigation and within twenty-four hours shall report the cause, source, and extent of contagion and infection, and all acts done and measures adopted in each case, and shall make such further reports as the secretary of the State board of health may require.

Rule 2.—In addition to the list of quarantinable diseases given in rule 1 of this section the following is a partial list of contagious, infectious, and communicable diseases, all of which, though not required to be quarantined, must be promptly reported in writing to the State board of health or its secretary by the said local health boards or chief executive health officers, viz: Chicken-pox, erysipelas, pneumonia, uncinariasis or hookworm, epidemic cerebro-spinal meningitis, trachoma, whooping-cough, mumps, dengue, dysentery, tuberculosis, typhoid fever, tetanus, malaria, leprosy, measles, German measles, glanders, and anthrax affecting human beings, rabies, pellagra, beriberi, syphilis, gonococcus infection, and poliomyelitis, and any disease which appears to have become epidemic. * * * This list can be changed at any time by the State board of health or its secretary.

* * * * * * *

Sec. 16. All physicians, nurses, clergymen, attendants, owners, proprietors, managers, employees, and persons living in or visiting any sick person in any hotel, lodging house, house, building, office, structure, or other place where any person shall be ill of any infectious, contagious, or communicable disease, shall promptly report such fact to the county, city and county, city, or other local health board or health officer, together with the name of the person, if known, and place where such person is confined and nature of the disease, if known.

* * * * * * *

Sec. 21 (as amended by sec. 4, ch. 339, Laws of 1911). Any person violating any of the provisions of this act, whether acting for himself or as the agent or servant of another person, or of a firm, company, or corporation, or as an officer, agent, employee, or rep-

resentative of any municipal corporation, or of the State shall be guilty of a misdemeanor, and upon conviction shall be punished by a fine of not less than twenty-five nor more than five hundred dollars, or by imprisonment for a term of not more than ninety days, or by both such fine and imprisonment. Each day that in violation of any provision of this act shall continue, and each day that any thing forbidden by the terms hereof to be erected, constructed, maintained, operated, or permitted, shall continue to exist, or be maintained, operated, or permitted, shall constitute a separate offense.

[Acts of 1911, Ch. 485.]

SECTION 1. Every medical practitioner attending on or called in to visit a patient whom he believes to be suffering from lead, phosphorus, arsenic or mercury or their compounds, or from anthrax, or from compressed air illness, contracted as a result of the nature of the patient's employment shall send to the State board of health a notice stating the name and full postal address and place of employment of the patient and the disease from which, in the opinion of the medical practitioner, the patient is suffering, and shall be entitled in respect of every bona fide notice sent in pursuance of this section to a fee of fifty cents, to be paid as part of the expense incurred by the State board of health in the execution of this act.

SEC. 2. If any medical practitioner, when required by this act to send a notice, wilfully fails forthwith to send the same, as provided by this act, he shall be guilty of a misdemeanor, and upon conviction of the same shall be fined not more than ten dollars.

SEC. 3. It shall be the duty of the State board of health to enforce the provisions of this act, and it may call upon local boards of health and health officers for assistance and it shall be the duty of all boards and officers so called upon for such assistance to render the same. It shall furthermore be the duty of said State board of health to transmit such data to the commissioner of the bureau of labor statistics.

COLORADO.

[Revised Statutes, 1908.]

SEC. 5025. If a conductor of any railroad discovers on his train a person suffering from cholera, smallpox, diphtheria, scarlet fever, or any other contagious disease, he shall at once communicate, either by telegraph or telephone, with a local railroad official located nearest the point at which the case is discovered, giving the number of his train, the number of the car, the name of the patient, and the nature of the disease suspected. The railroad official so informed must at once give the same intelligence to the nearest member of the State board of health or to the local health officer of his own town or city.

* * * * * * *

SEC. 5070. Whenever any householder shall know that any person within his family is taken sick with smallpox or any other disease dangerous to the public health, he shall immediately give notice thereof to the board of health or health officer of the town, city, or county in which he resides; and if he shall refuse or neglect to give such notice he shall upon conviction be fined in a sum not exceeding one hundred dollars.

* * * * * * *

SEC. 5072. Whenever any physician shall know that any person whom he is called to visit, or who is brought to him for examination, is infected with smallpox, cholera, diphtheria, scarlet fever, or any other disease dangerous to public health, he shall immediately give notice thereof to the health officer, the president or the clerk of the board of health of the county, town, or village in which the sick person may be, and to the householder, hotel keeper, keeper of a boarding house, or tenant within whose house or rooms the sick person may be. The notice to the officer of the board of

health shall state the name of the disease, the name, age, and sex of the person sick, also the name of the physician giving the notice, and shall, by street and number or otherwise, sufficiently designate the house or room in which said sick person may be; and every physician, and person acting as a physician, who shall refuse or neglect immediately to give such notice, shall for each offense, upon conviction, be fined in a sum not less than five nor more than one hundred dollars: *Provided*, That this penalty shall not be enforced against a physician if another physician in attendance has given to the health officer hereinbefore mentioned an immediate notice of such sick person, and the true name of the disease, in accordance with the requirements of this section.

Sec. 5073. Whenever the health officer of any county, city, or village in this State shall receive reliable notice, or shall otherwise have good reason to believe that there is within the county, city, or village of which he is the health officer, a case of smallpox, diphtheria, scarlet fever, or other communicable disease dangerous to the public health, it shall be the duty of the health officer, unless he is or shall have been instructed by the board of health, of which he is an executive officer, to do otherwise; * * * to promptly notify teachers or superintendents of schools concerning families in which are contagious diseases; * * * to keep the president of his own board of health and the secretary of the State board of health constantly informed respecting every outbreak of a disease dangerous to the public health, and of the facts, so far as the same shall come to his knowledge, respecting sources of danger of any such diseased person or infected article being brought into or taken out of the county, city, or village of which he is the health officer.

CONNECTICUT.

[General Statutes, 1902.]

Sec. 2508. When in any town, city, or borough, a case of smallpox, cholera, or any epidemic of infectious disease is known to exist, the local health officer of such town, city, or borough shall immediately notify the secretary of the State board of health of the existence of the same, with such facts as to its cause and continuance as may be known. Every person violating this section shall be fined not more than twenty-five dollars.

* * * * * * *

Sec. 2532. * * * The health officer of every town, city, and borough shall, on or before the eighth day of each month, make a report to the State board of health of all contagious diseases reported to him during the month preceding.

* * * * * * *

Sec. 2534. Every physician shall report in writing every case of cholera, yellow fever, typhus fever, leprosy, smallpox, diphtheria, membranous croup, typhoid fever, scarlet fever, or other contagious or infectious disease, except those of a venereal nature, occurring in his practice, to the health officer of the town, city, or borough in which such case occurs, within twelve hours after his recognition of the disease. Every person who shall violate any provision of this section shall be fined not more than twenty-five dollars.

Sec. 2535. Should one or both eyes of an infant become inflamed or swollen, or reddened at any time within two weeks after its birth, the midwife, nurse, or attendant having charge of such infant, shall report in writing, within six hours, to the health officer or board of health of the city, town, or borough in which the parents of the infant reside, the fact that such inflammation, swelling, or redness of the eyes exists. Every person violating the provisions of this section shall be fined not more than two hundred dollars.

Sec. 2546. Every hotel or lodging-house keeper, in whose house any lodger becomes sick of any malignant or contagious disease, shall within twelve hours after such lodger becomes sick report in writing to the board of health or health officer the name of such person if known and the nature of his disease.

[Acts of 1907, ch. 170.]

SEC. 1. The health officer or board of health of any town, city, or borough shall, within twenty-four hours after having received information of the existence or supposed existence within such town, city, or borough of the infectious disease known as rabies, give notice thereof to the commissioner on domestic animals. * * *

[Acts of 1909, ch. 79.]

SEC. 1. Tuberculosis is hereby declared to be an infectious and communicable disease dangerous to the public health. It shall be the duty of every physician to report in writing the name, age, sex, color, occupation, place where last employed, if known, and address of every person under his care known by such physician to have tuberculosis, to the health officer of the city, town, or borough in which such person resides, within twenty-four hours after such fact comes to the knowledge of such physician, and it shall be the duty of the officer in charge of any hospital, dispensary, asylum, or other similar institution to report in like manner concerning every patient having tuberculosis who comes under care or observatiom of such officer, within twenty-four hours thereafter.

DELAWARE.

[Acts of 1899, ch. 240.]

SEC. 4. All physicians, dentists, veterinary surgeons, or others practicing medicine or surgery or any branch thereof under the laws of this State shall be required to give prompt notice to the local or State board of health of any and all cases of contagious or infectious diseases that may come under their professional notice. * * *

[Acts of 1893, ch. 642.]

SEC. 11. (Added by sec. 6, ch. 327, Acts of 1903.) It shall be the duty of the boards of health authorities, and of physicians in rural districts or other localities where there are no health officials, to report to the board of health of the State of Delaware the existence of any case of contagious or infectious diseases which may come under their observation. * * *

[Acts of 1879–81, ch. 345.]

SEC. 17. (Added by sec. 3, ch. 328, Acts of 1903.) Every physician or other person having knowledge of any person who is suffering any disease dangerous to the public health, which the State board of health may require to be reported, shall report the same to the health board or official nearest his place of residence, giving the name, age, sex, and color of the patient and the house or place where he or she may be found. * * *

DISTRICT OF COLUMBIA.

[29 Stat. L., p. 635.]

For the purposes of this act the term "contagious disease" shall be held to mean Asiatic cholera, yellow fever, typhus fever, smallpox (including varioloid), leprosy, the plague, and glanders, or any of these diseases by whatever name it may be designated; the term "case of contagious disease" shall be held to mean any person suffering from any such disease. Any person shall be held to be suffering from a contagious disease who is so infected by such disease as to be capable of transmitting it to others. The presence of the ordinary clinical symptoms of any contagious disease shall be prima facie evidence that such case is or was such a disease; and the presence in such case of the specific bacteria of such disease shall be conclusive evidence that such case is or was such disease. The provisions of this act shall apply to every ship, vessel, steamer, boat, or craft lying or being in the rivers, harbors, or other waters within the

jurisdiction of said District, and to every tent, van, hovel, barn, outhouse, cabin, or other place in said District. The term "person in charge of a case of contagious disease" shall be held to mean, first, the head of the family in which such case belongs; second, in his absence or disability or in case he be the person sick, the nearest relative or relatives of such case present on the premises where such case is, and being in attendance on him; third, in the absence of such relatives everyone in attendance on such person; fourth, in the absence of anyone so in attendance, everyone in charge of the premises where such person is.

SEC. 2. Every physician attending on or called in to visit, or examining any case of contagious disease in the District of Columbia, shall * * * at once send to the health officer of said District a certificate signed by him, which said certificate shall state the name of the disease and the name, age, sex, and color of the person suffering therefrom and shall set forth by street and number, or otherwise sufficiently designate the house, room, or other place in which said person may be located, together with such other reasonable information relating thereto as may be required by said health officer. * * *

* * * * * * *

SEC. 4. Whenever any person in said District is suffering from any contagious disease, or suspected of being suffering from such disease, and no physician is in attendance on or called in to visit, or examine such person, it shall be the duty of the person in charge of such case * * * to send to said health officer certificates relative thereto, in the same manner as is required by this act of physicians attending on or called in to visit, or examining like cases.

[34 Stat. L., p. 889.]

Every person in charge of any patient in the District of Columbia who is suffering from diphtheria, scarlet fever, measles, whooping cough, chicken pox, epidemic cerebro-spinal meningitis, or typhoid fever, immediately after becoming aware of the existence of such disease, shall send to the health officer of said District a certificate written in ink, signed by such person, stating the name of the disease, the name, age, sex, and color of the person suffering therefrom, and the school, which he or she has attended, if any, and setting forth by street and number, or by other sufficient designation, the location of the house, room, or other place in which said patient can be found. When said patient recovers, or dies, said person in charge, as soon as possible thereafter, shall send to the health officer of said District a certificate, written in ink, certifying to that fact. But no person shall certify knowingly or negligently that any person has recovered from any disease aforesaid until such patient is in such condition as to be free from danger of communicating tho disease from which he is suffering to other persons.

SEC. 2. The term "person in charge of any patient," as used in this act, shall be held to mean, first, each physician in attendance on, called in to visit, or examining a patient, unless called in to visit or examining the patient solely as a consultant to a physician already in attendance; second, in the absence or disability of any physician aforesaid, or in event of default on the part of such physician, the head of the family to which the patient belongs; third, in the absence or disability of such person, or in event of default on the part of the physician aforesaid, the nearest relative or relatives of such patient present on the premises and in attendance on such patient; fourth, in the absence or disability of all persons aforesaid, or in event of default on the part of the physician aforesaid, every person in attendance on such patient. And in the cases of physicians and of persons acting in the capacity of physicians, attending, visiting, or examining any patient suffering from any disease aforesaid, shall be prima facie evidence that any person so doing was aware of the nature of such disease.

[35 Stat. L., p. 126.]

It shall be the duty of every physician in the District of Columbia to report in writing to the health officer of said District, within one week after the disease is recognized, on forms to be provided by said health officer, the name, age, sex, color, occupation, and address of every person under his care in said District, who, in his opinion, is afflicted with pulmonary or other communicable form of tuberculosis. It shall also be the duty of the officer having charge for the time being of each and every hospital, dispensary, asylum, or other similar public or private institution in said District to report in like manner the name, age, sex, color, occupation, and last address of every person who is in his care or who has come under his observation within one week of such time who, in his opinion, is afflicted with pulmonary or other communicable form of tuberculosis.

FLORIDA.

[General Statutes, 1906.]

SEC. 1114. It shall be the duty of every practicing or licensed physician in the State of Florida to report immediately to the president of the board of health, by telegram or in the most expeditions manner, every case of yellow fever, smallpox, or cholera that comes within his practice, such telegram to be paid for out of the funds provided for the expenses of said board of health.

* * * * * * *

SEC. 1146. Whenever a physician or other person shall report a suspicious case of disease to the State board of health as required by the provisions of section 3619 of the General Statutes of Florida, he shall also immediately give notice thereof to the city health officer, if there be any health officer, and if not to the mayor of the incorporated city or town in which the sick person may be; or if the sick person resides or he found outside of the limits of a city or town, to the county health physician or his representative, if there be any, and if not, to the chairman of the county commissioners of the county within which the sick person may be.

* * * * * * *

SEC. 3619. Whoever, being a licensed or practicing physician, fails to report immediately to the president of the State board of health by telegram (to be paid for out of the funds to be provided for the expenses of the said board of health), or in the most expeditious manner, every case of yellow fever, smallpox, or cholera that comes within his practice, shall be punished by imprisonment not exceeding six months, or by fine not exceeding one thousand dollars.

SEC. 3620. Any physician, city health officer, mayor, county health physician, or chairman of the board of county commissioners, who shall neglect or fail to comply with the provisions of sections eleven hundred and forty-six to eleven hundred and forty-eight, shall, upon conviction, be liable to a fine of one hundred dollars or imprisonment for thirty days.

GEORGIA.

[Penal Code of 1895.]

SEC. 499. Any physician or other person who shall conceal a case of smallpox, or varioloid, or any modification of the same, within any incorporated city. town, or in any county, by not giving immediate notice thereof to the mayor, intendant, or health officer, or ordinary, shall be punished as for a disdemeanor.

* * * * * * *

[Political Code of 1895.]

SEC. 1468. Any physician or other person who shall conceal a case of smallpox, or varioloid, or any modification of the same, within any incorporated city, town, or in any county in this State, by not giving immediate notice thereof to the mayor, intendant, or health officer, or ordinary, may be indicted.

[Acts of 1903, ch. 453.]

Sec. 5. It shall be the duty of the local boards of health and of physicians in localities where there are no health authorities, to report to the State board of health promptly upon the discovery thereof, the existence of any of the following diseases, to wit: Asiatic cholera, yellow fever, scarlet fever, smallpox, diphtheria, typhus or typhoid fever, and of such other contagious or infectious diseases as the State board of health from time to time may specify. * * *

HAWAII.

[Revised Laws, 1905.]

Sec. 988. * * * Said board (Territorial board of health) shall also, during the prevalence of any severe pestilence, or epidemic, publish a weekly report of the public health.

* * * * * * *

Sec. 1004. (As amended by Laws of 1911, act 125, sec. 1.) Physicians to report. It shall be the duty of every physician having a patient infected with cerebro-spinal meningitis, cholera asiatic, conjunctivitis follicular, diphtheria, dysentery amœbic, enteric (or typhoid) fever, fever para-typhoid, leprosy, measles, dengue, paralysis infantile, pertussis, plague, scarlet fever (or scarlatina), tetanus, trachoma, tuberculosis, typhus fever, varicella, variola, varioloid, yellow fever, or any other infectious or communicable or other disease dangerous to the public health to give immediate notice thereof to the board of health or its nearest agent, in writing, and in like manner to report to said board or its agent every case of death which takes place in his practice from any such disease; provided, however, that whenever a physician has a patient infected with variola, varioloid, scarlet fever, diphtheria, plague, cholera, yellow fever, typhus fever, cerebro-spinal meningitis or amœbic dysentery, such physician, in addition to the notice in writing required to be given as above, shall immediately notify the board of health or its nearest agent either by telephone or by direct oral communication. Every physician who shall refuse or neglect to give such notice or to make such report shall be fined for each offense a sum not less than ten nor more than one hundred dollars.

Sec. 1005. (As amended by Laws of 1911, act 125, sec. 2.) Others to report. It shall be the duty of every householder, keeper of a boarding or lodging house, or master of a vessel to report immediately to the board of health or its nearest agent any person in or about his house or vessel whom they shall have reason to believe to be sick or to have died of any infectious, communicable, or other diseases dangerous to the public health; and all police officers who are aware of any person suffering from any infectious, communicable, or other disease dangerous to the public health shall immediately report the same to the board of health or its nearest agent. Any such householder, keeper of a boarding or lodging house, master of a vessel, or police officer who shall refuse or neglect to so report immediately to the board of health or its nearest agent shall be guilty of a misdemeanor and upon conviction shall be fined not more than one hundred dollars for each offense.

Sec. 1005A. (Added by Laws of 1911, act 125, sec. 3.) Diseases declared infectious and communicable: Cerebro-spinal meningitis, cholera asiatic, conjunctivitis follicular, diphtheria, dysentery amœbic, enteric (or typhoid) fever, fever paratyphoid, leprosy, measles, dengue, paralysis infantile, pertussis, plague, scarlet fever (or scarlatina), tetanus, trachoma, tuberculosis, typhus fever, varicella, variola, varioloid, yellow fever are hereby declared to be infectious and communicable diseases dangerous to the public health, but this enumeration shall not be held to exclude any other disease that is infectious, communicable, or dangerous to the public health, though not specifically named herein.

* * * * * * *

SEC. 1124. It shall be the duty of every police officer or deputy sheriff having reason to believe that any person within his district is afflicted with leprosy, to report the same forthwith to the agent of the board of health in such district, if any, otherwise, to the nearest agent of the board of health.

SEC. 1125. Any police officer or deputy sheriff who shall wilfully fail to comply with the provisions of section eleven hundred and twenty-four shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined in a sum not less than ten dollars, nor more than two hundred dollars, and shall be dismissed from office.

[Laws of 1909, Act 81.]

SEC. 3. Every person who knows, or has reason to believe, that he, or any other person, not already under the care or control of the board of health, is a leper, shall, forthwith report to the board (of health) or its authorized agent, that fact and such other information relating thereto as he may have and the boerd may require.

[Laws of 1911, Act 118.]

SEC. 7. Reports by physicians and others. It shall be the duty of every physician in the Territory to report in writing the name, age, sex, nationality, occupation, place where last employed, if known, and address of every person known by said physician to have tuberculosis to the board of health or its nearest agent within twenty-four hours after such fact comes to the knowledge of said physician. It shall also be the duty of the superintendent in charge of any hospital, dispensary, asylum, or other similar private or public institution, to report in like manner the name, age, sex, nationality, occupation, place where last employed, if known, and previous address of every patient having tuberculosis who comes into his care or under his observation within twenty-four hours thereafter.

* * * * * * *

SEC. 15. Reporting recovery of pationt. Upon the recovery of any person having tuberculosis it shall be the duty of the attending physician to make a report of this fact to the board of health or its agent, who shall record the same, and shall relieve said person from further liability to any requirement imposed by this act.

IDAHO.

[Revised Codes, 1908.]

SEC. 663. The owner, or agent of the owner, of a house in which a person resides who has the smallpox, diphtheria, scarlet fever, or any other contagious or infectious disease, dangerous to the public health, and the physician called to attend the person or persons so affected shall, within twenty-four hours after becoming cognizant of the fact, give notice thereof to the clerk of the board of trustees of the school district in which said person so afflicted resides. * * *

* * * * * * *

SEC. 1108. Should one or both eyes of an infant become inflamed or swollen or reddened, or should any pus or secretion form in the eyes or upon the edge of the lid, at any time within two weeks after birth, it shall be the duty of any midwife, nurse, or other person having charge of such infant to report, within six hours after discovery of such inflammation, redness, or formation of pus or secretion, to the local health officers, or to some legally qualified practitioner of medicine in the district in which such case shall occur, the fact that such inflammation, swelling, or redness or accumulation in the eye exists. Any failure to comply with the provisions of this section shall be punished by a fine of not to exceed one hundred dollars, or imprisonment not to exceed ninety days, or by both fine and imprisonment, in the discretion of the court.

* * * * * * *

SEC. 1099. Every physician or other person called to attend any person who is suffering from smallpox, cholera, plague, yellow fever, typhus fever, diphtheria, membranous croup, scarlet fever, typhoid fever, or any other disease dangerous to the public health or required by the State board of health to be reported, shall report the same to the health officers within whose jurisdiction such person is found, giving in such report the name, age, sex, and color of the patient, and the house or place in which such person may be found. * * * In like manner it shall be the duty of the head of the family and of the owner or the agent of the owner of the building in which a person resides who has any of the diseases herein named or provided against, or in which are the remains of a person having died of any such disease, immediately after becoming aware of the fact to give notice thereof to the health officer.

* * * * * * *

SEC. 1111. It is the duty of every practicing physician to report promptly to the county physician of the county in which he resides, all or any dangerous disease of an infectious or contagious nature under treatment by him. * * * Any person violating the provisions of this chapter * * * is guilty of a misdemeanor.

ILLINOIS.

[Rev. Stat., 1909, ch. 34.]

SEC. 117. The said (county and township) boards of health shall have the following powers:

* * * * * * *

Fifth. To require reports of dangerously communicable diseases.

[Rev. Stat., 1909, ch. 38.]

SEC. 510. Should any midwife or nurse having charge of an infant in this State notice that one or both eyes of such infant are inflamed or reddened at any time within two weeks after its birth, it shall be the duty of such midwife or nurse having charge of such infant to report the fact in writing within six hours to the health officer or some legally qualified practitioner of medicine of the city, town, or district in which the parents of the infant reside.

SEC. 511. Any failure to comply with the provisions of this act shall be punishable by a fine not to exceed one hundred dollars or imprisonment not to exceed six months, or both.

[Rev. Stat., 1909, ch. 126a.]

SEC. 2. The State board of health * * * shall have authority to make such rules and regulations and such sanitary investigations as they may from time to time deem necessary for the preservation and improvement of the public health. * * * It shall be the duty of all local boards of health, health authorities, and officers, police officers, sheriffs, constables, and all other officers and employees of the State, or any county, village, city, or township thereof to enforce the rules and regulations that may be adopted by the State board of health.

* * * * * * *

SEC. 3. The board of health shall * * * make up such forms and recommend such legislation as shall be deemed necessary for the thorough registration of vital and mortuary statistics throughout the State. * * *

* * * * * * *

SEC. 12. It shall be the duty of the board of health to make an annual report, through their secretary, or otherwise in writing to the governor of this State, on or before the first day of January of each year, and such report shall include * * * such information concerning vital statistics, such knowledge respecting diseases * * * as may be thought useful by the board for dissemination among the people. * * *

[Acts of 1911, p. 330.]

SEC. 2. Every employer in this State engaged in the carrying on of any process of manufacture or labor in which sugar of lead, white lead, lead chromate, litharge, red lead, arsenate of lead, or Paris green are employed, used, or handled, or the manufacture of brass or the smelting of lead or zinc, which processes and employments are hereby declared to be especially dangerous to the health of the employees engaged in any process of manufacture or labor in which poisonous chemicals, minerals, or other substances are used or handled by the employees therein in harmful quantities or under harmful conditions, shall provide for and place at the disposal of the employees engaged in any such process or manufacture, and shall maintain in good condition and without cost to the employees, proper working clothing to be kept and used exclusively for such employees while at work, and all employees therein shall be required at all times while they are at work to use and wear such clothing; and in all processes of manufacture or labor referred to in this section which are unnecessarily productive of noxious or poisonous dusts, adequate and approved respirators shall be furnished and maintained by the employer in good condition and without cost to the employees, and such employees shall use such respirators at all times while engaged in any work necessarily productive of noxious or poisonous dusts.

SEC. 3. Every employer engaged in carrying on any process or manufacture referred to in section 2 of this act shall, as often as once every calendar month, cause all employees who come into direct contact with the poisonous agencies or injurious processes referred to in section 2 of this act, to be examined by a competent licensed physician for the purpose of ascertaining if there exists in any employee any industrial or occupational disease or illness or any disease or illness due or incident to the character of the work in which the employee is engaged.

SEC. 4. It is hereby made the duty of any licensed physician who shall make the physical examination of the employees under the provisions of section 3 of this act, to make an immediate report thereof to the State board of health of the State of Illinois upon blanks to be furnished by said board upon request, and if no such disease or illness is found, the physician shall so report, and if any such disease is found, the report shall state the name, address, sex, and age of such employee and the name of such employer, and the nature of the disease or illness with which the employee is afflicted, and the probable extent and duration thereof, and the last place of employment: *Provided*, That the failure of any such physician to receive the blanks of the State board of health for the making of such report, shall not excuse such physician from making the report as herein provided.

SEC. 5. The secretary of the State board of health shall, immediately upon receipt of any report from any physician in accordance with the provisions of section 4 of this act, transmit a copy thereof to the Illinois department of factory inspection.

SEC. 14. Any person, firm, or corporation who shall, personally or through any agent, violate any of the provisions of this act, or who omits or fails to comply with any of its requirements * * * shall be deemed guilty of a misdemeanor, and on conviction thereof shall be punished for the first offense by a fine of not less than ten dollars ($10) or more than one hundred dollars ($100), and upon conviction of the second or subsequent offenses shall be fined not less than fifty dollars ($50) or more than two hundred dollars ($200), and in each case shall stand committed until such fine and costs are paid, unless otherwise discharged by due process of law.

INDIANA.

[Burns' Annotated Statutes, 1908.]

SEC. 7596. It shall be the duty of the State board of health to collect and tabulate the vital statistics, to study them and endeavor to make intelligent and profitable use of the same for sanitary purposes and the benefit of the people. They shall have

supervision of the system of registration of * * * infectious and contagious diseases, and they shall make up from time to time such blank forms as they may deem necessary for the collection, registration, and report of vital and sanitary statistics throughout the State. * * *

* * * * * * *

SEC. 7607. It shall be the duty of all physicians and midwives in the State to report upon blank forms supplied by the State board of health * * * all cases of contagious and infectious diseases which may occur under their supervision and which are listed as reportable in the rules of the State board of health. The reports of * * * cases of infectious diseases shall be made immediately. * * * Reports of * * * cases of such infectious and contagious diseases as are listed in the rules of the State board of health, which occur in cities and towns, shall be made to health officers of said cities and towns, and when they occur in the country outside of cities and towns they shall be reported to the county health officer or his deputies. * * * When any * * * case of listed infectious or contagious disease may occur with no physician or midwife in attendance, then said * * * case of infectious or contagious disease shall be reported by the householder or other person having said * * * case of infectious or contagious disease in charge to the nearest health officer or his deputy, and the officer to whom the report is made shall make inquiry and inspection * * * and all reports of * * * contagious or infectious diseases as herein commanded shall be made upon blanks furnished by the State board of health. * * * All records of * * * cases of contagious and infectious diseases shall be kept by health officers in record books, the forms of which shall be supplied by the State board of health. Any physician or midwife refusing or neglecting to make * * * infectious or contagious disease reports as herein provided shall, upon conviction, be fined for the first offense in any sum not less than ten or more than fifty dollars, and any physician or midwife who is convicted the second time for the violation of any of the above provisions shall be fined not less than fifty or more than one hundred dollars, and any physician or midwife who is convicted the third time for the violation of any of the above provisions shall be fined one hundred dollars. Householders and others made responsible in this act and failing to report as herein provided shall, upon conviction, be fined not less than ten nor more than fifty dollars for each offense. * * *

* * * * * * *

SEC. 7612. Any physician called upon to attend a sick person and who finds the cause of such sickness to be of a contagious or infectious character, or if the disease is ordered to be reported in the rules of the State board of health, such physician shall immediately report the facts to the secretary of the board of health having jurisdiction.

SEC. 7613. Whenever any person knows or has reason to believe that any member of his or her family or household (boarder, roomer, or visitor) has either smallpox, diphtheria, membranous croup, scarlet fever, measles, or any other communicable disease listed in the rules of the State board of health, he or she shall immediately, from the time the existence of the disease is known, if no physician is in attendance, give notice thereof to the local health officer of the town or city in which the disease occurs, or the health officer if the case is without the corporation of cities or towns, and such notice shall be given either verbally or by written communication, mailed or delivered to such health officer or board.

[Acts of 1911, ch. 129.]

SEC. 3. Should one or both eyes of an infant become inflamed, swollen, or reddened, or show any unnatural discharge or secretion at any time within two weeks after its birth, and no legally qualified physician is in attendance upon the infant at that time, it shall be the duty of its parents, or, in their absence, whoever is caring for said infant,

to report the fact in writing, within six hours after discovery, to the health officer having jurisdiction: provided, said report to said health officer need not be made from recognized hospitals.

SEC. 5. Any violation of the provisions of this act shall be punished by a fine of not less than ten dollars and not more than fifty dollars.

IOWA.

[Code of 1897.]

SEC. 1027. It shall be the duty of such clerk and physician [to the board of health in cities under special charters] to report at least once a year to the State board of health * * * such other facts as may be required in blanks in accordance with instructions received from the State board. They shall also make special roports whenever required so to do by the State board.

SEC. 1028. The local board of health [in cities under special charters] shall make such rules and regulations and orders respecting * * * the prompt report of contagious or infectious diseases; * * * causes of sickness within their jurisdiction, and on all boats in its ports and harbors, or railroad cars passing through such city; * * * and shall, from time to time, report to the city council ordinances for carrying such rules, regulations, and provisions into effect. * * *

* * * * * * *

SEC. 2565. The board (State board of health) shall have * * * authority to make such rules and regulations and sanitary investigations as it from time to time may find necessary for the preservation and improvement of the public health, which when made shall bo enforced by local boards of health and peace officers of the State. It shall * * * by its secretary make biennial reports to the governor, which shall include * * * such information concerning vital statistics, such knowledge respecting diseases * * * as may be thought useful for dissemination among the people. * * *

* * * * * * *

SEC. 2568. * * * The quarantine authorized by this section in case of infectious or contagious diseases may be declared or terminated by the mayor of any city or town, or the township clerk outside of such city or town, in cases required by regulations of the State board of health, upon written notice given by any practicing physician of the existence of such disease, or termination of the cause for quarantine, as the case may be.

[Acts of 1896, ch. 57.[1]]

SECTION 1. Should one or both eyes of an infant become inflamed, or swollen, or reddened at any time within two weeks after its birth, it shall be the duty of the midwife, parent, guardian, or nurse, or other person having charge of such infant, to report within six (6) hours after the discovery thereof by such person in charge of such infant to the health officer or some legally qualified practitioner of the city, town, or district in which the parents of the infant reside, that such inflammation, or swelling, or redness of the eyes exists.

* * * * * * *

SECTION 3. Any failure to comply with the provisions of this act shall be punished by a fine of not less than twenty-five dollars or more than one hundred dollars or imprisonment in the county jail not to exceed thirty days, or both.

[1] Omitted from code of 1897. Sec. 27, ch. 20, acts of 1897, declares that the code is "the authoritative publication of the existing laws of the State."

KANSAS.

[General Statutes, 1909.]

SEC. 8031. The State board of health shall supervise * * * the registration of forms of disease prevalent in the State, and the secretary of said board shall superintend the registration of the vital statistics of the State. * * *

* * * * * * *

SEC. 8061. Tuberculosis is hereby declared to be an infectious and communicable disease, dangerous to the public health. It shall be the duty of every physician in the State of Kansas to report in writing, on a form to be furnished as hereinafter provided, the name, age, sex, color, occupation, place where last employed if known, and address of every person known by said physician to have tuberculosis, to the county health officer; or in cities of the first class, to the city health officer, in which said person resides, within twenty-four hours after such fact comes to the knowledge of said physician. It shall also be the duty of the chief officer having charge for the time being of any hospital, dispensary, asylum, or other similar private or public institution in said State of Kansas to report in like manner the name, age, sex, color, occupation, place where last employed, if known, and previous address of every patient having tuberculosis who comes into his care or under his observation, within twenty-four hours thereafter.

* * * * * * *

SEC. 8074. Whenever any physician shall know or have reason to believe that any person whom he is called to visit, or any person sick within his knowledge without the care of a physician, is sick with or has died of cholera, smallpox, scarlet fever, diphtheria, epidemic cerebrospinal meningitis, or any disease dangerous to the public health, he shall immediately give notice thereof to the nearest board of health or health officer. * * *

SEC. 8075. Whenever any householder shall know that any of his family is sick with or has died of smallpox, cholera, scarlet fever, diphtheria, epidemic cerebrospinal meningitis, or any disease dangerous to the public health, he shall immediately give notice thereof to the nearest board of health or health officer. * * *

SEC. 8076. Any municipal or county board of health or health officer having knowledge of any infectious or contagious disease, or of a death from such disease, within their jurisdiction, shall immediately exercise and maintain a supervision over such case or cases during their continuance. * * * The local board of health or health officer shall communicate without delay all information as to existing conditions to the State board of health.

KENTUCKY.

[Russell's Statutes, 1909.]

SEC. 1743. * * * and it shall be the duty of physicians practicing their profession in any county in which a local board is organized to report all or any of the above-mentioned diseases [cholera, smallpox, yellow fever, scarlet fever, diphtheria, and other epidemic and communicable diseases] under their special treatment to such local board, and it shall likewise be the duty of heads of families to report any of said diseases, when known by them to exist in their respective families, to such local board, or to some member thereof, within twenty-four hours from his or her knowledge of the existence of such disease, and such local board shall make report to the State board of health at least once in every three months.

First. Of the character of the infectious, epidemic, and communicable diseases prevailing in their county.

Second. The number reported as afflicted with such disease.

* * * * * * *

Sec. 1764 (as amended by ch. 11, Acts of 1910). The sum of thirty thousand dollars per annum * * * is appropriated for the following purposes * * *:

* * * * * * *

(c) To establish and maintain a bureau of vital statistics, that the causes of sickness and mortality may be known and utilized.

Sec. 1770. * * * Any physician or head of a family who shall fail or refuse to report to the local board of health cases of cholera, smallpox, yellow fever, scarlet fever, diphtheria, and other epidemic diseases, as provided for in section two thousand and fifty-five of the act mentioned in the title of this act, shall be fined not less than five dollars for each day he neglects or refuses to report.

* * * * * * * *

[Acts of 1910, ch. 37.]

Sec. 18. The State board of health shall prepare, print, and supply to all registrars suitable blanks and forms used in registering, recording, and preserving the returns or in otherwise carrying out the purposes of this act; and shall prepare and issue such detailed instructions as may be required to secure the uniform observance of its provisions and the maintenance of a perfect system of registration. And no other blanks shall be used than those supplied by the State board of health. The State registrar shall carefully examine the certificates received monthly from the local registrars, and if any such are incomplete or unsatisfactory, he shall require such further information to be furnished as may be necessary to make the record complete and satisfactory. And all physicians, midwives, or undertakers, connected with any case, are hereby required to furnish such information as they may possess regarding any birth, sickness or death, upon demand of the State registrar in person, by mail, or through the local registrar. He shall further arrange, bind, and permanently preserve the certificates in a systematic manner, and shall prepare and maintain a comprehensive and continuous card index of all births, sickness, and deaths registered, the cards to show the name of child, deceased, place and date of birth, sickness or death, number of certificate, and the volume in which it is contained. He shall inform all registrars what diseases are to be considered as infectious, contagious, or communicable and dangerous to the public health, as decided by the State board of health, in order that when sickness and deaths occur from such diseases proper precautions may be taken to prevent the spreading of dangerous diseases.

LOUISIANA.

[Act No. 192, 1898.]

Sec. 3 (as amended by Act 150, 1902). * * * It [the State board of health] shall prepare or cause to be prepared a sanitary code for the State of Louisiana, * * * said code shall cover and provide for * * * the reporting * * * of cases of infectious and contagious diseases. * * *

Sec. 8. In the event that any case shall be reported to or come to the knowledge of any local board, which is either deemed to be a case of contagious or infectious disease, or suspected of so being, the local board shall immediately * * * communicate the fact by the most expeditious means at hand to the State board of health. * * *

[Sanitary Code, 1909.]

62. (a) Whenever in any community of this State, any nurse, midwife, or other person not a legally qualified practitioner of medicine shall notice inflammation of the eyes or redness of the lids in a newborn child under his or her care, it shall be the duty of such person to report the same to the town or parish health officer within twelve hours of the time the disease is first noticed.

* * * * * * * *

MAINE.

[Rev. Stat., 1903, ch. 18.]

SEC. 30. * * * It [the local board of health] shall report to the State board of health promptly facts which relate to infectious and epidemic diseases, and every case of smallpox, varioloid, diphtheria, scarlet fever, typhoid fever, cerebrospinal meningitis, measles, membranous croup so called, whooping cough, and pulmonary tuberculosis or consumption, as it is commonly termed, occurring within the limits of its jurisdiction, and such notification shall be in accordance with the requirements of the blanks furnished by the said State board. * * *

* * * * * * *

SEC. 33 (as amended by ch. 78, Acts of 1909). Whenever any householder knows or has reason to believe that any person within his family or household has smallpox, diphtheria, scarlet fever, cholera, typhus or typhoid fever, cerebrospinal meningitis, measles, membranous croup so called, or whooping cough, he shall within twenty-four hours give notice thereof to the health officer of the town in which he resides, and such notice shall be given either at the office of the health officer or by a communication addressed to him and duly mailed within the time above specified, and in case there is no health officer to the secretary of the local board of health, either at his office or by communication, as aforesaid.

* * * * * * *

SEC. 36. Whenever any physician knows or has reason to believe that any person whom he is called upon to visit is infected with any of the diseases mentioned in section thirty-three, such physician shall, within twenty-four hours, give notice thereof to the secretary of the local board of health or the health officer of the town in which such person lives.

* * * * * * *

SEC. 90. If one or both eyes of an infant become reddened or inflamed at any time within four weeks after birth, the midwife, nurse, or person having charge of said infant shall report the condition of the eyes at once to some legally qualified practitioner of medicine of the city, town, or district in which the parents (of the infant) reside. Any failure to comply with the provisions of this section shall be punishable by a fine not to exceed one hundred dollars or imprisonment not to exceed six months.

[Acts of 1909, ch. 78.]

SEC. 1. The State board of health of Maine shall keep a register of all persons in this State who are known to be affected with tuberculosis. The State board of health shall have sole and exclusive control of said register and shall not permit inspection thereof nor disclose any of its personal particulars except to its own agents or to local officials when in the interest of the public health and safety it is deemed necessary to do so.

SEC. 2. Tuberculosis is hereby declared to be an infectious and communicable disease, dangerous to the public health. It shall be the duty of every physician in the State of Maine to report in writing, on forms to be furnished by the State board of health, the name, age, sex, color, occupation, place where last employed if known, and address of every person known by said physician to have tuberculosis to the secretary of the State board of health within forty-eight hours after such fact comes to the knowledge of said physician. The name of the householder where the tuberculous person lives or boards and such other facts as may be called for on the blank reports issued from the office of the State board of health shall also be included in the report. It shall also be the duty of the chief officer having charge for the time being of any hospital, dispensary, asylum, sanatorium, or other similar private or public institution in the State of Maine to report to the State board of health in like manner the name, age, sex, color, occupation, place where last employed if known, and previous address

of every patient having tuberculosis who comes into his care or under his observation within forty-eight hours thereafter. It shall also be the duty of said physician or chief officer to give notice to the secretary of the State board of health of the change of address of any tuberculous patient who is or has lately been under his care if he is able to give such information.

MARYLAND.

[Code of 1904, art. 27.]

SEC. 231. If at any time within two weeks after the birth of any infant one or both of its eyes, or the eyelids, be reddened, inflamed, swollen, or discharging pus, the midwife, nurse, or person other than a legally qualified physician, in charge of such infant, shall refrain from the application of any remedy for the same, and shall immediately report such condition to the health commissioner or to some legally qualified physician in the city, county, or town wherein the infant is cared for. Any person or persons violating the provisions of this section shall, on conviction, be punished by a fine not to exceed one hundred dollars, or by imprisonment in jail not to exceed six months, or by both fine and imprisonment.

[Code of 1904, art. 43.]

SEC. 21 B (created by ch. 560, acts of 1910). The bureau of communicable diseases [of the State board of health] shall secure accurate and complete returns of communicable diseases in Maryland. * * *

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SEC. 29. * * * He [any local or county health officer] shall promptly notify the secretary of the State board of health of the existence of any epidemic or unusual sickness or mortality that may come to his knowledge within his own sanitary jurisdiction or contiguous thereto. * * *

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SEC. 50. Whenever any householder knows that a person within his family or house is sick of smallpox, diphtheria, membranous croup, scarlet fever, typhoid fever, typhus fever, measles, mumps, whooping cough, or any other infectious or contagious disease dangerous to the public health, he shall immediately give notice thereof to the board of health of the city or county in which he dwells. * * *

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SEC. 51. Whenever any physician knows that any person whom he is called to visit is infected with smallpox, diphtheria, membranous croup, scarlet fever, typhoid fever, typhus fever, yellow fever, measles, whooping cough, or any other contagious or infectious disease dangerous to public health, he shall immediately give notice thereof in writing over his own signature, to the board of health of the city or town or county in which such disease exists; and if he refuses or neglects to give such notice he shall be fined not less than fifty nor more than two hundred dollars.

SEC. 52. The boards of health in the several cities, towns, and counties shall cause a record to be kept of all reports received in pursuance of sections fifty and fifty-one and such record shall contain the names of all persons who are sick with infectious or contagious diseases, the localities in which they live, the disease with which they are affected, together with the date and names of the persons reporting any such cases, and the record of quarantine, isolation, disinfection, and other preventive measures. * * *

SEC. 53. When any board of health has had notice of the occurrence, within its sanitary jurisdiction, of a case of smallpox, or any other contagious or infectious disease dangerous to public health, such board of health shall, within twenty-four hours after the receipt of such notice, notify the State board of health of the same.

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SEC. 56. The State board of health of Maryland shall keep a register of all persons in this State who are known to be affected with tuberculosis. The State board of health shall have sole and exclusive control of said register, and shall not permit inspection thereof nor disclose any of its personal particulars except to officials authorized under the laws of Maryland to receive such information.

SEC. 57. The superintendent or other person in charge or control of any hospital, dispensary, school, reformatory, or other institution deriving the whole or any part of its support from the public funds of the State of Maryland or any city, town, or county in the State of Maryland, having in charge or under care or custody any person or persons suffering with pulmonary or laryngeal tuberculosis shall within forty-eight hours after recognition of such disease make or cause to be made in the manner and form prescribed by the State board of health a record of the name, age, sex, color, occupation, social condition, and residence of the person or persons so affected, together with such other information as may seem necessary or important. And all such records shall be delivered under seal to the State board of health on Monday of the week immediately following that in which the records were made. * * *

SEC. 58. Whenever any physician knows that any person under his professional care is affected with pulmonary or laryngeal tuberculosis he shall transmit to the secretary of the State board of health within seven days and upon blanks provided by the State board of health for that purpose the name, age, sex, color, occupation, social condition, and residence of such person, and any physician failing or refusing to comply with the requirements of this section shall be deemed guilty of a misdemeanor and on conviction thereof shall be subject to a fine of ten dollars.

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SEC. 67. Whenever any hotel keeper, keeper of a boarding or lodging house, superintendent, manager, or director of a private or public institution of any kind, shall know or be informed by a physician, or shall have reason to believe that any guest, inmate, or other person in the hotel, boarding house, lodging house, or institution over which he or she may have control or supervision, or on the premises thereof, is sick with or convalescing from smallpox, cholera, yellow fever, typhus or typhoid fever, scarlet fever, leprosy, or any other contagious or infectious disease, the said owner, proprietor, manager, or other person having charge shall immediately give notice thereof in writing to the health officer of the city or town in which the infected house or premises is located, or to the secretary of the State board of health if there is no local health officer who can efficiently deal with the case; said notice shall state the name and place of residence of the person sick, the name of the disease, the name of the owner, proprietor, or manager of the house, and the locality of said house. * * *

SEC. 68. Any person or persons who shall neglect or refuse to comply with the provisions of the two foregoing sections shall be deemed guilty of a misdemeanor, and shall, upon conviction thereof in a court of competent jurisdiction, be fined not more than fifty dollars for every such offense.

MASSACHUSETTS.

(Revised Laws, 1902, ch. 75.)

SEC. 49 (as amended by Acts of 1910, ch. 269). A householder who knows that a person in his family or house is sick of smallpox, diphtheria, scarlet fever, or any other infectious or contagious disease declared by the State board of health to be dangerous to the public health shall forthwith give notice thereof to the board of health of the city or town in which he dwells. * * * Should one or both eyes of an infant become inflamed, swollen, and red, and show an unnatural discharge at any time within two weeks after its birth it shall be the duty of the nurse, relative, or other attendant having charge of such infant to report in writing within six hours thereafter to the board of health of the city or town in which the parents of the infant reside the fact that such inflammation, swelling, and redness of the eyes and unnatural discharge exist. * * *

SEC. 50 (as amended by Acts of 1907, ch. 480). If a physician knows that a person whom he is called to visit is infected with smallpox, diphtheria, scarlet fever, or any other disease declared by the State board of health to be dangerous to the public health, or if one or both eyes of an infant whom or whose mother he is called to visit become inflamed, swollen, and red, and show an unnatural discharge within two weeks after the birth of such infant, he shall immediately give notice thereof in writing over his own signature to the selectmen or board of health of the town; and if he refuses or neglects to give such notice he shall forfeit not less than fifty nor more than two hundred dollars for each offense.

SEC. 51. The board of health shall keep a record, in blank books to be provided by the secretary of the Commonwealth, of all reports received pursuant to the two preceding sections, which shall contain the name and location of all persons who are sick, their disease, the name of the person who reports the case, and the date of such report. Said board shall give immediate information to the school committee of all contagious diseases so reported to them.

SEC. 52 (amended by Acts of 1907, ch. 480). If the board of health of a city or town has had notice of a case of smallpox, diphtheria, scarlet fever, or of any other disease declared by the State board of health to be dangerous to the public health therein, it shall within twenty-four hours thereafter give notice thereof to the State board of health stating the name and location of the patient so afflicted, and the secretary thereof shall forthwith transmit a copy of such notice to the State board of charity.

SEC. 53 (amended by Acts of 1902, ch. 213). If such board refuses or neglects to give such notice, the city or town shall forfeit its claim upon the Commonwealth for the payment of expenses as provided in section one of chapter two hundred and thirteen of the acts of the year nineteen hundred and two.

[Acts of 1907, ch. 183.]

SEC. 1. The State board of health is hereby authorized and directed to define what diseases shall be deemed to be "dangerous to the public health," as the term is used in chapter two hundred and thirteen of the acts of the year nineteen hundred and two.

MICHIGAN.

[Compiled Laws of 1897.]

SEC. 4452. Whenever any householder, hotel keeper, keeper of a boarding house, or tenant shall know, or shall be informed by a physician, or shall have reason to believe that any person in his family, hotel, boarding house, or premises is taken sick with smallpox, cholera, diphtheria, scarlet fever, or any other disease dangerous to the public health, he shall immediately give notice, in writing, thereof to the health officer of the township, city, or village in which he resides. Said notice shall state the name of the person sick, the name of the disease, if known, the name of the householder, hotel keeper, keeper of boarding house, or tenant giving the notice, and shall, by street and number, or otherwise, sufficiently designate the house in which he resides or the room in which the sick person may be; and if he shall refuse or wilfully neglect immediately to give such notice, he shall be deemed guilty of a misdemeanor, and upon conviction thereof he shall be punished by a fine of not exceeding one hundred dollars and costs of prosecution; or in default of payment thereof, by imprisonment not exceeding ninety days in the county jail, in the discretion of the court * * *.

SEC. 4453. Whenever any physician shall know that any person whom he is called to visit, or who is brought to him for examination, is infected with smallpox, cholera, diphtheria, scarlet fever, or any other disease dangerous to the public health, he shall immediately give notice thereof to the health officer of the township, city, or village in which the sick person may be; and to the householder, hotel keeper, keeper of a

boarding house, or tenant within whose house or rooms the sick person may be. The notice to the officer of the board of health shall state the name of the disease, the name, age, and sex of the person sick, also the name of the physician giving the notice; and shall, by street and number, or otherwise, sufficiently designate the house or room in which said person sick may be. * * *

SEC. 4454. For each complete notice in writing to an officer of the board of health, in full compliance with the preceding section, requiring from physicians, or other person, notices of diseases dangerous to the public health, the physician who gave the notice shall be entitled, on duly certifying that each notice was correct, and when the bill has been duly audited by the board of health, to receive from the township, city, or village, in which the notice was given, the sum of ten cents.

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SEC. 4460. Whenever the health officor of any township, city, or village in this State shall receive reliable notice or shall otherwise have good reason to believe that there is within the township, city, or village of which he is the health officer, a case of small-pox, diphtheria, scarlet fevor, or other communicable disease dangerous to the public health, it shall be the duty of said health officer, * * * to keep the president of his own board of health, and the secretary of the State board of health constantly informed respecting every outbreak of a disease dangerous to the public health, and of the facts so far as the same shall come to his knowledge, respecting sources of danger of any such diseased person or infected article being brought into or taken out of the township, city, or village of which he is the health officer.

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SEC. 4475. Should one or both eyes of an infant become inflamed or swollen, or reddened, or should any pus or secretion form in the eyes or upon the edge of the lids, at auy time within two weeks after birth, it shall be the duty of any midwife, nurse, or other person having charge of such infant to report in writing within six hours after discovery of such inflammation, redness, or formation of pus or secretion, to the local health officer or some legally qualified practitioner of medicino in the city, town, or district in which such case shall occur, the fact that such inflammation, swelling, or redness, or accumulation in the eyes exists.

[Public acts of 1909, No. 27, as amended by Act 317, 1909, and Act 80, 1911.]

SEC. 1. Tuberculosis is hereby declared to be an infectious and communicable disease. It shall be the duty of every physician in the State of Michigan to report in writing on a form to be furnished as hereinafter provided, tho name, nativity, age, sex, color, occupation, place where last employed if known, and address, of every person known by said physician to have tuberculosis, to the health officer of the township, city, or village in which said person resides, within twenty-four hours after such fact comes to the knowledge of said physician. It shall also be the duty of the chief officer having charge for tho time being of any hospital, dispensary, asylum, or other similar private or public institution in said State of Michigan, to report in like manner the name, nativity, age, sex, color, occupation, place where last employed, if known, and previous address of every patient having tuberculosis who comes into his care or under his observation, withiu twenty-four hours thereafter.

SEC. 2. This report shall be upon a blank form furnished by the State board of health, and such blank, in addition to tho name, color, age, sex, nativity, occupation, placo where last employed, and present address, as stated above, shall give also the evidence upon which the diagnosis of tuberculosis has been made, the part of the body affected, and the stage of the disease. * * *

"SEC. 4. *Protection of records.*—It shall be the duty of every health officer of a township, city, or village to cause all reports made in accordance with the provisions of the first section of this act, and also all results of examinations showing the presence

of the bacilli of tuberculosis made in accordance with the provisions of the third section of this act, to be recorded in a register to be furnished by the State board of health, of which he shall be the custodian, and a copy of which he shall transmit quarterly to the State board of health. Such register shall not be open to inspection by any person other than the health authorities of the State and of the said township, city, or village, and said health authorities shall not permit any such report or record to be divulged so as to disclose the identity of the person to whom it relates, except as may be necessary to carry into effect the provisions of this act. The cost of all blanks, vouchors, and registers hy this act required to be furnished or issued hy the State board of health shall be paid for hy the board of State auditors out of the general fund in the State treasury, on presentation of vouchers approved by the secretary of the State board of health.

"SEC. 11. *Penalty for failure of physician to perform duties or for making false reports.*—Any physician or person practicing as a physician who shall fail to report any case of tuberculosis or who shall knowingly report as affected with tuberculosis any person who is not so affected, or who shall wilfully make any false statement concerning the name, nativity, age, sex, color, occupation, place where last employed, if known, or address of any person reported as affected with tuberculosis, or who shall certify falsely as to any of the precautions taken to prevent the spread of infection, shall he deemed guilty of a misdemeanor and on conviction thereof shall be subject to a fine of not more than one hundred dollars.

"SEC. 12. *Reporting recovery of patient.*—Upon the recovery of any person having tuberculosis, it shall be the duty of the attending physician to make a report of this fact to tho local health officer, who shall record the same in the records of his office, and shall relieve said person from further liahility to any requirements imposed by this act.

"SEC. 12a. In addition to the requirements of the reports hereinbefore provided, such reports shall comprehend tho occupation at the time disease was contracted and the date thereof, as near as can be, the time thereafter continued at such occupation and all subsequent occupations and term of each to the time of the death or recovery of any person having tuberculosis, and it shall be the duty of every health officer of township or village or city to cause all reports to be made in accordance with tho first section of this act, and this section and record copy transmitted as required hy section four, and upon the receipt of the full quarterly report hy the State board of health, said State board of health shall compile such report to show the numher and location of each case, the number of deaths and numher of recoveries, the age, sex, color, occupation at time person contracted, the disease, the time continued in the occupation when disease was contracted and all suhsequent occupations and term of each up to death or recovery of such person, and so classify same, showing percentage of deaths in each trade or occupation from tuberculosis, as compared with the whole number of deaths in such trade or occupation as shown hy the latest reports of local physicians to the local health hoards as reported to the State board of health: *Provided*, That such compilation shall he published once overy year in the reports of said State board of health; that such reports so made up shall be at all times open to the inspection of the puhlic: *Provided further*, That the names of the persons so diseased shall not bo published.

"SEC. 13. *General penalty.*—Any person violating any of the provisions of this act shall be deemed guilty of a misdemeanor and upon conviction thereof shall be punished, except as herein otherwise provided, hy a fine of not less than five dollars nor more than fifty dollars.

"SEC. 14. *Repealing all acts, et cetera.*—All acts and parts of acts contrary to or inconsistent with the provisions of this act are herehy repealed."

[Public Acts of 1909, No. 293.]

SEC. 1. * * * The said State board of health is hereby expressly authorized to designate what diseases are dangerous communicable diseases and what diseases are contagious diseases, and it shall be the duty of every local board of health and health officer to observe such rules in relation to dangerous communicable diseases and contagious diseases as may be prescribed by the said State board of health.

[Laws of 1911, act 119.]

SECTION 1. Every physician attending or called upon to treat a patient whom he believes to be suffering from poisoning from lead, phosphorus, arsenic, or mercury, or their compounds, or from anthrax, or from compressed air illness, contracted as a result of the nature of the patient's employment, shall send to the State board of health, who shall transmit to the commissioner of labor a notice stating the name, post-office address, and place of employment of the patient, the length of time of such employment, and the disease from which, in the opinion of the physician, the patient is suffering.

SEC. 2. Any physician who shall fail to make any report required by the preceding section, or who shall wilfully make any false statement in such report, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be punished by a fine of not more than fifty dollars.

SEC. 3. It shall be the duty of the commissioner of labor and of the prosecuting attorney of the county where anyone violating the provisions of this act may reside, to prosecute all violations of the provisions of this act which shall come to the knowledge of them or either of them.

MINNESOTA.

[Revised Laws of 1905.]

SEC. 2130. The board [State board of health] shall * * * gather and diffuse proper information upon all subjects to which its duties relate. It shall gather, collate, and publish medical and vital statistics of general value * * *

SEC. 2131. The board [State board of health] may adopt, alter, and enforce reasonable regulations of permanent application throughout the whole or any portion of the State, or for specified periods in parts thereof, for the preservation of the public health. Upon the approval of the attorney general, and the due publication thereof, such regulations shall have the force of law, except in so far as they may conflict with a statute or with the charter or ordinances of a city of the first class upon the same subject. In and by the same the board may control * * * any of the following matters:

* * * * * * *

7\. * * * the reporting of sicknesses and deaths therefrom.

* * * * * * *

SEC. 2135. All local boards of health and health officers shall make such * * * reports, and obey such directions concerning communicable diseases, as the State board may require or give. * * *

MISSISSIPPI.

[Code of 1906, ch. 34.]

1645\. The duties of the bureau on vital statistics of the department shall be (1) to appoint a county board of health in each county of the State, consisting of one physician of skill from each supervisor's district, for the purpose of collecting vital, mortuary, and sanitary statistics, of which board the county health officer shall be chairman; and said board may keep books of register for * * * infectious diseases, in which may be kept a register of all the * * * infectious diseases that may occur in the county.

(2) To carry out the rules and regulations as to the collection of vital, mortuary, and sanitary statistics in the State that shall be adopted by the State board of health.

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2498. Every practicing or licensed physician shall report immediately to the secretary of the State board of health every case of yellow fever, cholera, dengue, smallpox or other virulent epidemic contagious diseases that occurs within his practice, unless the State board of health shall otherwise direct. * * *

2505. Any municipality may * * * enforce the collection and registration of * * * health and mortuary statistics; but the same shall be subject to and not inconsistent with the rules and regulations of the State board of health touching the health interests of the county in which such city, town, or village is situated.

[Acts of 1910, ch. 130.]

Sec. 1. It shall be the duty of all practicing physicians in this State to report to the secretary of the State board of health any and all cases of tuberculosis, consumption or other pulmonary diseases, which they shall be called on to examine or treat, within ten days after receiving knowledge of such cases. * * *

Sec. 3. Any practicing physician who shall fail to make the reports provided for in section 1 of this act, shall be guilty of a misdemeanor, and, upon conviction, shall be fined not less than ten dollars nor more than fifty dollars.

MISSOURI.

[Annotated Codes of 1906.]

Sec. 7520. The State board of health shall * * * recommend to the municipal authorities of any city, or to the county courts of any county, the adoption of any rules that they may deem wise or expedient for the protection and preservation of the health of the citizens thereof.

Sec. 7528. It shall be the duty of the board of health to make annual report, through its secretary or otherwise, in writing, to the governor of this State, on or before the first day of January of each year, and such report shall include * * * such information concerning vital and mortuary statistics, such knowledge respecting diseases * * * as may be thought useful by the board for dissemination among the people. * * *

MONTANA.

[Revised Codes, 1907.]

Sec. 1486. * * * He [the secretary of the local board of health] shall keep accurate records of all communicable diseases reported to him, and for this purpose each local board of health shall provide, at the expense of the city or town, a book printed in proper blank form for the notation of such facts and data as may be prescribed by the regulations of the State board of health. * * *

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Sec. 1495. * * * He [the local and county health officer] shall on or before the fifth day of each month, transmit to the secretary of the State board of health, on blanks provided therefor, a complete report of all communicable diseases reported to him during the previous month, giving all the details regarding each case as indicated by the blank forms provided by the State board of health. * * *

* * * * * * *

Sec. 1500. The term "communicable disease" as used in this act, shall be understood to include the following diseases: Smallpox, diphtheria, membranous croup, so-called scarlet fever, sometimes called scarlet rash or scarlatina, cholera, bubonic plague, yellow fever, "spotted" or "tick" fever, typhus fever, enteric or typhoid fever, cerebro spinal meningitis and measles.

Sec. 1501. Whenever any householder knows or has reason to believe that any person within his family or household has any communicable disease, he shall immedi-

ately give notice thereof to the health officer of the town or city in which he resides, if within the corporate limits of a town or city, or to the county health officer if without the corporate limits of a town or city, and such notice shall be given at the office of the local or county health officer within the shortest possible time and by the most direct means of communication.

SEC. 1502. Whenever any physician knows that any person whom he is called upon to visit is infected with any communicable disease, such physician shall immediately give notice of such disease to the local health officer, if within the corporate limits of a town or city, or to the county health officer if without the corporate limits of a town or city.

NEBRASKA.

[Compiled Statutes, 1881, 14th ed., 1909.]

SEC. 4403. The State board of health * * * shall collect and preserve such information as may be useful in the discharge of its duties, and for dissemination among the people.

SEC. 4404. It shall be the duty of all boards of health now in existence or that may hereafter be created, and of physicians in localities where there are no health authorities, or where such health authorities fail to act, to report to the State board of health promptly upon the discovery thereof, the existence of any one of the following diseases, viz, Asiatic cholera, yellow fever, smallpox, scarlet fever, diphtheria, typhus and typhoid fever and such other contagious and infectious diseases as the State board of health may from time to time specify; and each and every member of any such board of health, or other officer or physician, who knowing of the existence of any such disease shall fail promptly to report the same in accordance with the provisions of this section, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not less than ten dollars nor more than one hundred dollars for each and every such offense.

NEW HAMPSHIRE.

[Public Statutes, 1891, ch. 110.]

SEC. 3 (as amended by Acts of 1901, ch. 13). It shall be the duty of every physician who attends upon any person infected with the smallpox, the malignant cholera, diphtheria, scarlet fever, or other malignant pestilential disease, immediately to report the same to the health officers, or in their absence to the selectmen of the town. If any physician shall neglect so to do, he shall be fined one hundred dollars, or be imprisoned not exceeding ninety days, or both.

[Acts of 1901, ch. 16.]

SEC. 2. Whenever any person knows or has reason to believe that any member of his family or household (boarder, roomer, or visitor) has either smallpox, diphtheria, membranous croup, scarlet fever, typhoid fever, measles, or any other malignant communicable disease, he shall, within twenty-four hours, if no physician is in attendance, give notice thereof to the local board of health of the town or city in which he resides, and such notice shall be given either verbally to one of the health officers, or by a communication addressed to the board of health and duly mailed within the time specified.

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SEC. 5. Upon the appearance of either of the diseases named in section 2 in any town or city in the State, the board of health shall make an immediate report to the State board of health upon blanks furnished for that purpose, and shall thereafter make a weekly report as long as the disease continues, stating number of cases, number of infected houses, fatality, and such other facts as may be required by the State board of health.

[Acts of 1903, ch. 45.]

Sec. 1. It shall be the duty of every physician who attends upon any person whom he suspects is infected with smallpox to immediately report the same to the health officers of the town in which said person then resides, or if there be no health officers, then to the selectmen of the town. * * *

[Acts of 1911, ch. 6.]

Sec. 1. It shall be the duty of every physician practicing medicine or surgery in the State of New Hampshire to report in writing to the State board of health, within one week after the disease is recognized, on forms to be provided by the said board, the name, age, sex, color, occupation, and address of every person under his care in this State who in his opinion is infected with pulmonary or other form of tuberculosis. It shall also be the duty of the officer having charge for the time being of each and every hospital, dispensary, asylum, or other public or private institution in the State to report in like manner the name, age, sex, color, occupation, and last address of every person in his care, or who has come under his observation within one week of such time, who in his opinion is infected with pulmonary or other form of tuberculosis.

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Sec. 3. The State board of health shall cause all cases showing the presence of tubercle bacilli to be recorded in a register, of which the board shall be the custodian and which shall not be open to inspection, nor shall the board permit any such record to be divulged in any manner to disclose the identity of the person to whom it relates except to a health officer, if deemed necessary, to carry out the provisions of this act.

* * * * * * *

Sec. 5. Upon the recovery of any person who has been found to be infected with tuberculosis a report to that effect shall be made to the State board of health by the attending physician and shall be recorded in the register aforesaid, and shall relieve the said person from further liability to any requirement imposed by this act.

* * * * * * *

Sec. 7. Any person violating the provisions of this act shall, upon conviction thereof, be deemed guilty of a misdemeanor and shall be punished by a fine of ten dollars, or imprisonment for thirty days, or both.

[Acts of 1911, ch. 17.]

Sec. 1. Upon the appearance of smallpox, typhoid fever, or any other dangerous communicable disease in any unincorporated locality in this State it shall be the duty of any person having knowledge thereof immediately to notify the State board of health of the appearance of such disease, provided there is no local board of health having jurisdiction in the locality.

* * * * * * *

Sec. 3. Any person violating the provisions of this act or any regulation established thereunder, shall be fined ten dollars for each offense.

NEW JERSEY.

[General Statutes, 1895, p. 1676.]

Sec. 1. Should one or both eyes of an infant become inflamed, swollen, or reddened, or show any unnatural discharge at any time within two weeks after its birth and no legally qualified practitioner of medicine be in attendance upon the infant at the time, it shall be the duty of the midwife, nurse, attendant, or relative having charge of such infant to report the fact in writing, within 6 hours, to the local board of health of the city, township, or other municipality in which the parents of the infant reside.

[Acts of 1911, ch. 380.]

A supplement to an act entitled "An act for the protection of the public health," approved March twenty-second, one thousand eight hundred and ninety-five.

Sec. 1. Every physician who shall attend any person sick with typhoid fever, dysentery, scarlet fever, diphtheria, or tuberculosis, on any dairy premises where milk is produced for sale or distribution, shall report to the secretary of the State board of health within twelve hours after he first ascertained that any such person is sick with any of said diseases, which report shall be in writing, and shall state the nature of the disease, the name of the person who is ill with said disease, and the location of the place where such person is ill as aforesaid, and the name of the owner or manager of said dairy premises if the same can be ascertained.

Sec. 2. Every physician who shall attend any person sick with any of the diseases mentioned in section one, who shall have knowledge of the fact that any member of the family of such person ill as aforesaid, or any person living in the same family, is employed on any dairy premises where milk is produced for sale or distribution, shall report to the secretary of the State board of health in writing, within twelve hours after he first ascertained that any such person is sick as aforesaid, or within twelve hours after gaining the information above mentioned as aforesaid, which report shall state the name of the person who is ill with said disease, the nature of the disease, and the location of the place where such person is sick as aforesaid, and shall further specify the name of the member of the family of such person or of the person living in the same family as the person ill as aforesaid who is employed on dairy premises as aforesaid, and the name of the owner or manager thereof if the same can be ascertained, and the location of the dairy premises where said person is employed.

Sec. 3. Every person who shall fail to make the report provided for by sections one and two of this act in the manner and within the time therein mentioned, shall, for every such failure, forfeit the sum of fifty dollars, to be recovered in the manner provided for the recovery of penalties in the act to which this act is a supplement.

[Acts of 1911, ch. 381.]

An act to amend an act entitled "An act for the protection of the public health," approved March twenty-second, one thousand eight hundred and ninety-five.

Sec. 1. Section one of the act to which this act is amendatory be, and the same hereby is, amended so that it shall read as follows:

"Sec. 1. Every physician shall, within twelve hours after his first professional attendance upon any person who is suffering from cholera, yellow fever, typhus fever, leprosy, plague, trichinosis, smallpox, varioloid, enteric or typhoid fever, diphtheria, membranous croup, scarlet fever, malaria, tuberculosis in any of its manifestations, trachoma, hydrophobia, glanders, anthrax, chicken-pox, anterior poliomyelitis or infantile paralysis, or any other contagious, infectious, or communicable disease which may hereafter be publicly declared by the State board of health to be preventable and specially dangerous to the public health, report such sickness to the assessor of the township in which such sickness may be; if such sickness be within the limits of the jurisdiction of any local board of health other than the local board of health of any township, then such physician shall report such sickness to the secretary of the local board of health having jurisdiction over the territory within which such sickness may be, if such board has a secretary; if such board has no secretary, then to the clerk of such board; provided, however, that any local board of health may designate some officer of such board, other than the clerk, secretary, or township assessor, to receive such reports, in which case all such reports shall be made to such officer; such report shall be in writing, signed by such physician, and shall set forth the name, age, and precise location of the person suffering from such disease; and every house owner or householder who has reason to believe that any person living, dwelling, or being in any building under his control is affected by any of the contagious, infectious, or

communicable diseases hereinabove specified or referred to, shall, when no physician has professionally attended such sick person, within twelve hours after discovering the same, report the fact in writing to the same person and in the same manner as any physician attending such sick person would be required to do as hereinabove set forth; and on the thirtieth day of June and the thirty-first day of December in each and every year every physician, house owner, and householder making any report or reports, as in this section required, shall be entitled to receive from the officer to whom such report or reports shall have been made during the preceding six months, a certificate in writing under the hand of such officer, setting forth the number of names of persons reported to have been affected with any of the diseases hereinabove specifically named or referred to, which certificate when presented by such physician, house owner, or householder to the proper disbursing officer of the city, borough, town, or other local municipal government or township within which such affected person may have been, shall entitle such physician, house owner, or householder to receive from such disbursing officer the sum of ten cents for each and every name by such certificate certified to have been reported, unless such notification shall be found to have been erroneous; and any physician, house owner, or householder who shall fail to perform the above-mentioned duty at the time and in the manner above provided shall be liable to a penalty of fifty dollars for each such failure."

SEC. 2. Section two of the act of which this act is amendatory be, and the same hereby is, amended so that it shall read as follows:

"SEC. 2. That the facts contained in every report filed pursuant to the provisions of the first section of this act shall be entered by the officer to whom the same shall be delivered in a book kept exclusively for that purpose, which book shall be subject to the inspection of the local board of health and its proper officers and to the State board of health and its officers only; the officer to whom such report shall be delivered, and whose duty it is to make record of same, as in this section above set forth, shall also, at least once in each week, and daily when required by the State board of health, transmit the facts stated therein by mail to the secretary of the board of health of the State of New Jersey, at Trenton, and shall upon request by the said State board of health or any of its officers give full information concerning the measures which are employed by the local board of health to prevent the spread of the disease in such reports mentioned, which facts and information shall be conveyed to the secretary of the said State board of health in writing; any officer whose duty it is to make any report to said State board of health or the secretary thereof, as in this section above provided, and who fails to perform such duty at the time and in the manner above provided, shall be liable to a penalty of fifty dollars for each and every such failure of duty. Proof that the secretary of said State board of health has not received the report of such facts or such information from any such officer shall be prima facie evidence that such facts and information have not been transmitted to said secretary by such officer. Every officer whose duty it is to receive the reports mentioned in section one of this act shall, during the month of October in each year, upon presentation of a certificate signed by the secretary of the State board of health stating the whole number of such cases reported as aforesaid from each municipality or township by such officer to the State board of health during the preceding year, be entitled to receive, from the proper disbursing officer of the township, city, borough, town, or other local municipal government within the limits of which the sickness so reported occurred, the sum of ten cents for each case reported, as aforesaid, to the secretary of the State board of health: *Provided, however*, That such officer shall not be entitled to any payment for or on account of any such case unless report of such case was received by the secretary of the said State board of health within ten days after the date such said case was reported to the officer transmitting the same, and no such case shall be included in such certificate unless so received. Such certificates shall be sent to the officers above mentioned during the month of October of each year."

SEC. 3. This act shall take effect immediately.

[Acts of 1910, ch. 169.]

SEC. 1. Tuberculosis is hereby declared to be an infectious and communicable disease, dangerous to the public health. It shall be tho duty of every physician in the State of New Jersey to report in writing, signed by him, the name, age, sex, color, occupation, place where last employed, if known, and address of every person known by said physician to have tuberculosis to the local board of health of the city, borough, town, or other municipality in this State in which said person resides, within forty-eight hours after such fact comes to the knowledge of said physician. It shall also be the duty of the chief officer having charge for the time being of any hospital, asylum, prison, or other private or public institution in said State of New Jersey to report in like manner the name, age, sex, color, occupation, place where last employed, if known, and previous address of every patient having tuberculosis who comes into his care or under his observation within forty-eight hours thereafter.

NEW MEXICO.

[Acts of 1903, ch. 103.]

SEC. 19. Whenever any physician or other person shall know that any person is sick with smallpox or other contagious or infectious disease * * * dangerous to the public health, he shall at once give notice thereof, if within the limits of any incorporated city, town, or village, to the health officer for the county in which such city, town, or villago is situated; and if not within such city, town, or village, then to the justice of the peace in the precinct in which such disease * * * exists. Whenever such notice is given to any justice of the peace it shall be his duty to at once notify the health officer of the county. Any physician, justice of the peace, or other person failing, neglecting, or refusing to perform any duty imposed upon him by this section shall be guilty of a misdemeanor * * *.

SEC. 20. Whenever any householder shall know that any person in his family is sick with smallpox or other contagious disease dangerous to the public health he shall immediately give notice thereof required by tho last preceding section, and upon failure to give such notice shall be deemed guilty of a misdemeanor, and punished upon conviction as in said section provided.

* * * * * * *

NEW YORK.[a]

[Consolidated Laws, 1909, ch. 45.]

SEC. 5. There shall be in the State department of health a bureau of vital statistics for tho registration of births, marriages, deaths, and prevalent diseases, which shall be under the general charge and supervision of the commissioner of health. He shall prescribe and prepare the necessary methods and forms for obtaining and preserving such statistics and to insure the prompt and faithful registration of the same in the several municipalities and in the State bureau. * * * If defects exist in any registration under the supervision of a local board of health the commissioner shall notify the local board that such defects must be amended and prevented within 10 days from the date of the notice. If such defects are not so amended or prevented, the commissioner shall take control of such registration and record thereof and enforce the rules and regulations in regard thereto, and secure a complete registration in such municipality, and such control shall continue until the local board satisfies the commissioner that it will make such record and registry complete, as required by law. * * *

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[a] See also page 156.

SEC. 12. The commissioner of health shall annually on or before the first Monday in February make a written report to the governor upon the vital statistics and sanitary conditions * * * of the State. * * *

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SEC. 25. * * * Every physician shall immediately give notice of every case of infectious and contagious or communicable disease required by the State department of health to be reported to it, to the health officer of the city, town, or village where such disease occurs; and no physician being in attendance on such case it shall be the duty of the superintendent or other officer of an institution, householder, hotel, or lodging-house keeper, or other person where such case occurs, to give such notice. The physician or other person giving such notice shall be entitled to the sum of twenty-five cents therefor. * * * Every such local board of health shall report to the State department of health, promptly, the facts relating to infectious and contagious or communicable diseases, and every case of smallpox or varioloid within the municipality. Health officers of cities, villages, and towns shall report in writing once a month to the State department of health all cases of such infectious and contagious or communicable diseases as may be required by the State department of health, and for such reporting the health officer of a village or town shall be paid by the municipality employing him * * * a sum not to exceed twenty cents for each case so reported. The reports of cases of tuberculosis made pursuant to the provisions of this section shall not be divulged or made public, so as to disclose the identity of the persons to whom they relate, by any person; except insofar as may be necessary to carry out the provisions of this section. * * * The health officer, commissioner of health, or boards of health of the cities of the first class shall report promptly to the State department of health all cases of smallpox, typhus and yellow fever, and cholera and the facts relating thereto.

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SEC. 127. The health officer shall keep the department of health of the city of New York informed of the number of cases of quarantinable diseases and the character of the same held at quarantine, and he may receive any vessel or merchandise sent to him by the health authorities of New York which in his opinion is dangerous to the public health.

SEC. 129. The quarantinable diseases are yellow fever, plague, cholera, typhus or ship fever, and smallpox, and any other infectious disease which has been or may be determined to be quarantinable by the health officer. * * *

SEC. 320. Tuberculosis is hereby declared to be an infectious and communicable disease, dangerous to the public health. It shall be the duty of every physician in the State of New York to report in writing, on a form to be furnished as hereinafter provided, the name, age, sex, color, occupation, place where last employed, if known, and address, of every person known by said physician to have tuberculosis, to the health officer of the city, town, or village in which said person resides, within twenty-four hours after such fact comes to the knowledge of said physician. It shall also be the duty of the chief officer having charge for the time being of any hospital, dispensary, asylum, or other similar private or public institution in said State of New York to report in like manner the name, age, sex, color, occupation, place where last employed, if known, and previous address of every patient having tuberculosis who comes into his care or under his observation, within twenty-four hours thereafter.

* * * * * * *

§ 322. *Protection of records.*—It shall be the duty of every health officer of a city, town, or village to cause all reports made in accordance with the provisions of section three hundred and twenty, and also all results of examinations showing the presence of the bacilli of tuberculosis, made in accordance with the provisions of section three

hundred and twenty-one, to be recorded in a register, of which he shall be the custodian. Such register shall not be open to inspection by any person other than the health authorities of the State and of the said city, town, or village, and said health authorities shall not permit any such report or record to be divulged so as to disclose the identity of the person to whom it relates, except as may be necessary to carry into effect the provisions of this article.

§ 329. *Penalty for failure of physician to perform duties or for making false reports.*—Any physician or person practicing as a physician who shall knowingly report as affected with tuberculosis any person who is not so affected, or who shall wilfully make any false statement concerning the name, age, sex, color, occupation, place where last employed if known, or address of any person reported as affected with tuberculosis, or who shall certify falsely as to any of the precautions taken to prevent the spread of infection, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be subject to a fine of not more than one hundred dollars.

§ 330. *Reporting recovery of patient.*—Upon the recovery of any person having tuberculosis, it shall be the duty of the attending physician to make a report of this fact to the local health officer, who shall record the same in the records of his office, and shall relieve said person from further liability to any requirements imposed by this article.

§ 331. *General penalty.*—Any person violating any of the provisions of sections three hundred and twenty to three hundred and thirty, both inclusive, of this article, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished, except as in this article otherwise provided, by a fine of not less than five dollars nor more than fifty dollars.

§ 332. *Application of provisions.*—No portion of sections three hundred and twenty and three hundred and thirty-one, both inclusive, shall apply to the city of New York, nor shall the passage of said sections modify or repeal any of the provisions of the charter of the city of New York, or any rule or regulation issued by the department of health of said New York City.

NORTH CAROLINA.

[Revisal of 1905.]

SEC. 4439. Bulletins of the outbreak of disease dangerous to the public health shall be issued by the State board whenever necessary, and such advice freely disseminated to prevent and check the invasion of disease into any part of the State. * * *

[Acts of 1911, ch. 62.]

SEC. 16. All laws pertaining to the reporting, recording * * * of the diseases mentioned in section eighteen, * * * shall be faithfully enforced by the quarantine officer. * * *

SEC. 17. If a householder knows that a person within his family is sick with smallpox, diphtheria, scarlet fever, measles, whooping cough, yellow fever, typhus fever, cholera, or bubonic plague he shall immediately give notice thereof to the quarantine officer or the deputy quarantine officer.

SEC. 18. If a physician suspects that a person whom he is called to visit is infected with smallpox, diphtheria, measles, whooping cough, scarlet fever, typhus fever, yellow fever, cholera, or bubonic plague * * * he shall immediately give notice thereof to the quarantine officer or deputy quarantine officer.

SEC. 19. The quarantine officer shall record on duplicate forms supplied by the State board of health and in accordance with instructions furnished therewith, all diseases reported in pursuance of sections eighteen and nineteen. The said officer receiving notice of the diseases named in sections eighteen and nineteen shall make the following report: First, the quarantine officer shall notify the secretary of the State board of health, by telegram, within twenty-fours after receiving information

of the presence of yellow fever, cholera, typhus fever, or bubonic plague, of the existence of every case of the aforesaid diseases; second, the quarantine officer shall notify the teacher or principle in the school attended by members of the family of the sick child, on blank forms furnished by the State board of health, within twenty-four hours after receiving information of the presence of yellow fever, cholera, typhus fever, bubonic plague, diphtheria, scarlet fever, measles, or whooping cough, of the existence of every case of the said diseases; third, the quarantine officer shall mail to the secretary of the State board of health, not later than the fifth day of the following month, the original record of all cases of yellow fever, smallpox, measles, cholera, typhus fever, bubonic plague, diphtheria, scarlet fever, and whooping cough, for the preceding month: *Provided*, That the quarantine officers are hereby empowered to appoint, if they desire, one deputy quarantine officer in each township of the county; the tenure of office of such deputy shall be terminable at the pleasure of the quarantine officer. The deputy quarantine officer, upon receiving notice of the existence of any of the diseases mentioned in sections eighteen and nineteen, shall at once notify the quarantine officer, upon suitable blank forms supplied him for this purpose. * * * The quarantine officer shall be liable for the neglect or refusal of his deputy to carry out the provisions of this act. Any householder, physician, quarantine officer, or any other person who violates the provisions of this section shall be guilty of a misdemeanor, and upon conviction thereof shall be liable to a fine of not less than ten dollars nor more than fifty dollars, or imprisonment for not less than ten nor more than thirty days, and shall be liable to a penalty of twenty-five dollars in favor of any person who shall sue for the same. The chairman of the board of county commissioners shall be responsible for the enforcement of sections eighteen, nineteen, * * * of this act in his jurisdiction. Failure on his part to enforce its provisions shall be a misdemeanor, and he shall be liable to a fine of not less than ten dollars nor more than fifty dollars. * * *

Sec. 21. The county, town, or city treasurer, as the case may be, shall pay twenty-five cents each, or more if necessary, for the execution of this act, to the quarantine officer upon presentation of a certified statement from the secretary of the State board of health of the number of cases of the diseases mentioned in section nineteen reported to the said secretary for the preceding month. * * *

NORTH DAKOTA.

[Revised Codes of 1905.]

Sec. 257. The superintendent of public health shall on the first day of December of each even numbered year make a full report to the governor, which report shall show * * * the character and extension during such time of all contagious and infectious diseases that have been reported to him * * *

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Sec. 260. * * * The county superintendent of health shall * * * whenever any contagious or infectious disease occurs in his county, either among persons or domestic animals, immediately report the same to the superintendent of public health.

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Sec. 275. Whenever it shall come to the knowledge of any physician or other person that a contagious, epidemic, or infectious disease exists within the jurisdiction of any local board, he shall immediately report to such board in writing the name and place of residence, if known, of every person afflicted with such disease, and if he is the attending physician of such person he shall report not less than twice in each week the condition of each person so afflicted and the state of such disease.

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Sec. 277. Each keeper of any private house, boarding house, lodging house, inn, or hotel shall report in writing to the local board of health within whose jurisdiction the same may occur each case of contagious, infectious, or epidemic disease which may

occur in his house, inn, or hotel; such report shall be made within twenty-four hours after the existence of such disease shall become known to such person, and shall state the name of each person afflicted with such disease and the nature thereof.

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SEC. 282. * * * Whenever it shall come to its knowledge that a case of smallpox, scarlet fever, diphtheria, or other infectious or contagious disease exists within its jurisdiction, * * * the local board of health shall * * * immediately notify the State board of health of the existence and nature of such disease. * * *

SEC. 288. The health officer of each city, the clerk of each civil township, and in counties not organized into civil townships, the county commissioner of such county for the district for which he was elected, and the superintendent of the county board of health of each county in the State, shall obtain and register the following facts concerning the * * * contagious and infectious diseases occurring therein, separately numbering and recording the same in the order in which he obtains them, designating in separate columns, viz, * * *; in the registry of infectious and contagious diseases, the name of the person affected, the sex, color, and age of the person, the nature of the disease, and the date of record. The county auditor of each county shall furnish each officer within his county, charged with the duties herein provided, at the expense of the county, a book in which to register the facts concerning * * * infectious and contagious diseases as herein provided. The superintendent of each county board of health shall keep his records in the office of the county judge of said county.

SEC. 289. Where no physician is employed, it shall be the duty of the parents to give notice to the proper office within whose jurisdiction they reside, * * * of the presence of any infectious or contagious disease occurring within their household, within twenty-four hours, * * * and the oldest person next of kin, the keeper or other proper officer of every workhouse, poorhouse, reform school, jail, prison, hospital, asylum, or other public or charitable institution, shall give like notice of any * * * infectious or contagious disease occurring among the persons under his charge. * * *

SEC. 290. * * * Any physician attending a case of infectious or contagious disease shall immediately notify the health officer within whose jurisdiction such disease exists, giving the name of patient, place of residence, and the character of the disease, and shall in addition thereto, for the purpose of keeping the record of vital statistics complete, certify the facts to the clerk of the civil township within whose district such disease occurred, or in counties not organized into civil townships then to the county commissioner having the proper jurisdiction, giving the name of the patient, place of residence, and character of the disease. * * *

SEC. 291. It shall be the duty of the health officer of each city and the clerk of each organized civil township of each county in this State, and in counties not organized into civil townships, the county commissioner of such county for the district for which he was elected, to make and send a copy of the registry of * * * infectious and contagious diseases to the superintendent of the county board of health of each county in the State not later than the 10th of each month a certified copy of the registry of * * * infectious or contagious diseases occurring within the preceding month; and the superintendent of the county board of health of each county in this State shall make and send to the State superintendent of health on or before the fifteenth day of each month a copy of the records showing all * * * infectious or contagious diseases reported to him for the preceding month within his county. * * *

SEC. 292. The superintendent of each county board of health shall, on or before the fifteenth day of each month, transmit to the superintendent of the State board of health, upon blanks furnished him by the State board of health, a certified copy of the registry of * * * infectious and contagious diseases which have occurred in said county within the calendar month immediately preceding, as reported to him

by the officers charged with the collection of vital statistics within his county. For obtaining, registering, and returning the facts herein required the county superintendent of health shall receive a sum of ten cents for each separate record of * * * infectious and contagious diseases so made and reported, to be paid out of the general fund of such county in the same manner as other bills and accounts against said county are allowed and paid. For neglect to perform such duties as are herein required the county superintendent of health shall forfeit a sum not exceeding fifty dollars for each offense, to be collected as other fines are collected by law.

[Acts of 1911, ch. 188.]

SEC. 3. Should one or both eyes of an infant become inflamed, swollen, or reddened or show any unnatural discharge or secretion at any time within two weeks after its birth, and no legally qualified physician is in attendance upon the infant at that time, it shall be the duty of its parents or, in their absence, whoever is caring for said infant, to report the fact in writing within six hours after discovery to the health officer having jurisdiction: *Provided,* Said report to said health officer need not be made from recognized hospitals.

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SEC. 5. Penalty.—Any violation of the provisions of this act shall be punished by a fine of not less than ten dollars nor more than fifty dollars.

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OHIO.

[General Code, 1910.]

SEC. 1243. Boards of health, health authorities or officials, and physicians in localities where there are no health authorities or officials shall report to the State board of health promptly upon the discovery thereof the existence of any one of the following diseases: Asiatic cholera, yellow fever, smallpox, scarlet fever, diphtheria, membranous croup, typhus or typhoid fever, and such other contagious or infectious diseases as the State board specifies.

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SEC. 4427. Each physician or other person called to attend a person suffering from smallpox, cholera, plague, yellow fever, typhus fever, diphtheria, membraneous croup, scarlet fever, or typhoid fever, or any other disease dangerous to the public health, or required by the State board of health to be reported, shall report to the health officer within whose jurisdiction such person is found, the name, age, sex, and color of the patient, and the house and place in which such person may be found. In like manner, the owner or agent of the owner of a building in which a person resides who has any of the diseases herein named or provided against, or in which are the remains of a person having died of any such disease, and the head of the family, immediately after becoming aware of the fact, shall give notice thereof to the health officer.

SEC. 4428. When complaint is made or a reasonable belief exists that an infectious or contagious disease prevails in a house or other locality which has not been so reported the board shall cause such house or locality to be inspected by its health officer, * * *

SEC. 12787. Whoever, being a midwife, nurse, or relative in charge of an infant less than ten days old, fails within six hours after the appearance thereof to report in writing to the physician in attendance upon the family, or if there be no such physician to a health officer of the city, village, or township in which such infant is living, or, in in case there be no such officer, to a practitioner of medicine legally qualified to practice, that such infant's eye is inflamed or swollen or shows an unnatural discharge, if that be the fact, shall be fined not less than five dollars nor more than one hundred dollars or imprisoned not less than thirty days nor more thau six months, or both.

OKLAHOMA.

[Snyder's Compiled Laws, 1909.]

SEC. 349. It shall be the duty of all practicing physicians in each county to make a report to the county superintendent of public health for said county, upon forms as prescribed and furnished by the State board of health, of all the cases of infectious and contagious diseases. Such report shall be made by said physician as soon as the disease is discovered, and upon failure on the part of the physician to so report said disease as herein provided, he shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in a sum not less than ten dollars and not more than twenty-five dollars. * * *

SEC. 350. It shall be the duty of any practicing physician in cities of the first class, in counties of this State, to make a report to the city superintendent of public health, upon forms prescribed and furnished by the State board of health, of all cases of infectious and contagious diseases, as soon as discovered by him or coming to his knowledge. Any failure upon the part of said physician to report said disease as herein provided, shall be deemed guilty of misdemeanor, and upon conviction thereof, shall be fined in the sum of not less than twenty-five dollars nor more than one hundred dollars. * * * It shall be the duty of said city superintendent of public health to make a full report from time to time to the State board of health as to all cases of contagious and infectious diseases existing within said city at such times and under such rules and regulations that said State board of health may require. * * *

OREGON.

[Acts of 1903, p. 82.]

SEC. 8. * * * It shall be the duty of the county board of health * * * to report to the secretary of the State board of health monthly, not later than the tenth day, all infectious diseases, * * * that may have been reported to said board of health during the preceding month, excepting cities wherein vital statistics are collected, and in such cases the health officer, or other persons whose duty it is to collect said statistics, must send to the secretary of the State board of health, not later than the tenth day of the month, a transcript of his monthly records of deaths * * * and all infectious diseases reported to him.

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SEC. 12. * * * Every physician, or other person, under whose charge any infectious or epidemic disease occurs, must report the same to the county or city health officer immediately. * * *

PENNSYLVANIA.

[Purdon's Digest, 13th ed., p. 1886.]

78. Should one or both eyes of an infant become inflamed, or swollen and reddened, at any time within two weeks after birth, it shall be the duty of the midwife or nurse or other person having the care of such infant, to report in writing within six hours after the discovery thereof to the health officer, or legally qualified practitioner of the city, town, or district in which the mother of the child resides, the fact that such inflammation, or swelling, or redness exists.

[Acts of 1909, ch. 658.]

SEC. 1. Every physician, practicing in any portion of this Commonwealth, who shall treat or examine any person suffering from, or afflicted with, actinomycosis, anthrax, bubonic plague, cerebrospinal meningitis (epidemic), (cerebrospinal fever, spotted fever), chicken pox, Asiatic cholera, diphtheria (diphtheritic croup, membranous croup, putrid sore throat), epidemic dysentery, erysipelas, German measles, glanders (farcy), rabies (hydrophobia), leprosy, malarial fever, measles, mumps,

pneumonia (true), puerperal fever, relapsing fever, scarlet fever (scarlatina, scarlet rash), smallpox (variola, varioloid), tetanus, trachoma, trichiniasis, tuberculosis in any form, typhoid fever, typhus fever, whooping cough, or yellow fever, shall, if said case shall be located in a township of the first class, a borough, or a city, forthwith make a report in writing to the health authorities of said township, city, or borough; and, if said case shall be located in a township of the second class, or a city, borough, or township of the first class not having a board of health or body acting as such, to the State department of health, upon blanks supplied for that purpose; in which report he shall, over his or her own signature, state the name of the disease, and the name, ago, sex, color, nativity, and occupation, if any, of the person suffering therefrom, together with the street and house number of the premises in which said person may be located, or otherwise sufficiently designate the same, the date of the onset of the disease, tho name and occupation of the householder in whose family the disease may have occurred, the number of children in said household attending school, and the name or names of the school or schools so attended, together with such other information relating so said case as may he required by said health authorities and the State department of health.

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SEC. 9. Blanks whereon to make the reports * * * required by this act shall be supplied in cities, boroughs, and townships of the first class hy tho health authorities thereof, respectively; and in townships of the second class, and in cities, boroughs, and townships of the first class not having boards of health or bodies acting as such, by the State department of health.

SEC. 10. It shall be the duty of the health authorities of cities, boroughs, and townships of the first class, respectively, to furnish daily, hy mail or otherwise, to principals, superintendents, teachers, and other persons in charge of puhlic, private, parochial, Sunday, and other schools, a printed or written hulletin containing the name, location, and disease of all persons suffering from any of the diseases mentioned in sections three, four, five, six, and seven of this act, upon receipt by them of reports of such cases from physicians, as required hy section one of this act; and such bulletin shall be daily furnished to such persons in charge of such schools in townships of the second class, and in cities, boroughs, and townships of the first class, not having boards of health or bodies acting as such, hy the State department of health.

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SEC. 23. The health authorities of the several cities, boroughs, and townships of the first class shall, at the end of each week and for the fraction of each week occurring at the end of each month, report to the State department of health, upon blanks supplied for that purpose, a list of all cases of communicahle diseases mentioned in section one of this act which have been reported to them during said period, which report shall contain the name of each person suffering therefrom, respectively, and his or her age, sex, color, and nativity, together with the name of the disease and the date of tho onset thereof; and in the event of no reports of any of said diseases having heen received hy the aforesaid health authorities, respectively, during any said period, that fact shall be reported to the State department of health. All superintendents and other persons in charge of asylums, hospitals, or other institutions located in townships of the second class shall at the end of each week and portion of a week occurring at the end of each month report to the State Department of health on blanks to be supplied for that purpose, a list of the inmates of such institutions, respectively, who may have suffered from any of the diseases enumerated in section one of this act, together with the ahove-mentioned data relative to each inmate, with the date of his or her admission to the institution, and the name of the city, borough, or township from which he or she was admitted.

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SEC. 24. * * * Any physician, * * * or any other person or persons, who shall fail, neglect, or refuse to comply with, or who shall violate any of the provisions of this act shall, for every such offense, upon conviction thereof in a summary proceeding before any magistrate or justice of the peace of the county wherein said offense was committed, be sentenced to pay a fine of not less than twenty ($20) dollars or more than one hundred ($100) dollars, to be paid to the use of said county, or to be imprisoned in the county jail for a period of not less than ten nor more than thirty days, or both, at the discretion of the court.

PORTO RICO.

[Laws of 1911, act 68.]

SEC. 25. * * * Physicians shall report to the nearest health officer any of the following diseases: Exanthematic typhus, typhoid fever, smallpox, varioloid, scarlet fever, diphtheria, yellow fever, Asiatic cholera, bubonic plague, beriberi, epidemic dysentery, cerebro-spinal meningitis, whooping cough, epidemic parotiditis, malaria, tuberculosis, glanders, leprosy, cutaneous syphilis, and hookworm disease, or uncinariasis.

SEC. 26. It shall be the duty of practicing physicians to report to tho local health officer all cases of infectious or contagious diseases treated by them, and it shall be the duty of health officers to immediately report all such cases to the director of sanitation. It shall be likewise the duty of veterinarians to report to the director of sanitation any disease of the animals under their care, such as bacteroid carbuncle, tuberculosis, actinomycosis, gangrenous septicaemia, glanders, or any other epidemic disease.

RHODE ISLAND.

[General Laws, 1909, ch. 96.]

SEC. 10 (added by acts of 1909–10, ch. 386). It shall be the duty of the State board of health to keep a register of all persons in this State who are known to be affected with laryngeal or pulmonary tuberculosis. The State board of health shall have sole exclusive control of said register and shall not permit the inspection thereof nor disclose any of its personal particulars except to officials authorized under the laws of this State to receive such information.

SEC. 11 (added by acts of 1909–10, ch. 386). The superintendent, or other person, in charge or control of any hospital, school, reformatory, or other institution, deriving the whole or any part of its support from the public funds of the State of Rhode Island, having in charge or under his care and custody any person or persons suffering with pulmonary or laryngeal tuberculosis, shall, within forty-eight hours after recognition of such disease, make, or cause to be made, in the manner and form prescribed by the State board of health, a record of the name, age, sex, color, occupation, social condition, and residence of the person or persons so affected, together with such other information as may be determined by the State board of health. Said information to be furnished on blanks supplied by the State board of health, and said information shall be forwarded each week to tho office of the secretary of the State board of health on said blanks. * * *

SEC. 12 (added by acts of 1909–10, ch. 386). Whenever any physician knows that any person under his professional care is affected with pulmonary or laryngeal tuberculosis, he shall transmit to the secretary of the said State board of health within seven days, and upon blanks provided by the State board of health for that purpose, tho name, sex, age, color, occupation, social condition, and residence of such person. * * *

[General Laws, 1909, ch. 110.]

SEC. 13. Every householder or person shall immediately inform the town council of the town wherein he dwells, of any person in the house or tenement occupied by him, who has been taken sick of the smallpox, or any other contagious or infectious distemper, or suspected to be so.

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SEC. 19. Every physician, householder, or other person, having knowledge of the existence of smallpox in any town, shall immediately give information thereof to the town clerk of the town in which the person is sick with the smallpox, and in cities shall give like information to the superintendent of health.

SEC. 20. Whenever the town clerk of any town shall have knowledge or shall have received information as provided in the preceding section of the existence of smallpox in his town, he shall forthwith give or cause notice thereof to be given to the town council of such town, at the expense of the town, to be audited and allowed by the town council.

]General Laws of 1909 (ch. 343).]

SEC. 25. Should any midwife or nurse, or person acting as nurse, having charge of an infant in this State, notice that one or both eyes of such infant are inflamed or reddened at any time within two weeks after its birth, it shall be the duty of such midwife or nurse, or person acting as nurse, so having charge of such infant, to report the fact in writing within six hours to the health officer, or some qualified practitioner of medicine, of the city or town in which the parents of the infant reside.

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SEC. 27. Every person who shall fail to comply with the provisions of the two sections next preceding shall be fined not exceeding one hundred dollars, or imprisoned not exceeding six months, or both.

[Acts of 1911, ch. 728.]

SECTION 1. Any physician who may discover a case or cases of anterior poliomyelitis, tubercular meningitis, or cerebrospinal meningitis shall immediately report the existence of each and every case of said diseases to the secretary of the State board of health, together with such information as said secretary may require.

SOUTH CAROLINA.

[Criminal Code, 1902.]

SEC. 331. Should one or both eyes of an infant become reddened or inflamed at any time after birth, it shall be the duty of the midwife or nurse or person having charge of said infant to report the condition of the eyes at once to the local board of health of the city or town in which the parents of the infant reside.

Any failure to comply with the provisions of this section shall be punishable by a fine not to exceed twenty-five dollars or imprisonment not to exceed one month, or both.

This section shall not apply to towns or cities of less than one thousand inhabitants.

[Act No. 395, 1910.]

SEC. 1. In all cases of known or suspected contagious or infectious diseases occurring within any incorporated city or town of this State, it shall be the duty of the attending physician to report such disease to the secretary of the board of health of each city or town within twenty-four hours, stating the name and address of the patient, and the nature of the disease.

SEC. 2. It shall be the duty of the secretary of each local board of health to report to the secretary of the State board of health all such cases of infectious and contagious

diseases as have been reported to him during the preceding months, such reports to be made upon blanks furnished by the State board of health, and not later than the fifth day of each month.

SEC. 3. It shall be the duty of the attending physician in all cases of known or suspected contagious or infectious diseases outside of incorporated cities and towns, to report such cases to the secretary of the State board of health within twenty-four hours after they have come under his observation, said reports to be made upon blanks furnished by the State board of health.

SEC. 4. The State board of health is hereby authorized to name the diseases it considers contagious and infectious.

SEC. 5. Any physician or secretary of a local board of health, failing to comply with the provisions of this act, shall be deemed guilty of a misdemeanor, and upon conviction shall be fined in a sum not less than five dollars nor more than twenty-five dollars, or be imprisoned in the county jail for a period not exceeding thirty days.

SOUTH DAKOTA.

[Political Code, 1903.]

SEC. 248. * * * The superintendent of the county board of health shall be ex-officio secretary of the board of health of his county, * * * and shall at the end of every month make a full report in writing to the superintendent of tho State board of health * * * of the condition of the public health, and whenever any contagious or infectious disease occurs in his county shall immediately report the same to the superintendent of the State board of health.

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SEC. 253 * * * Any practicing physician or other person who shall fail to report to the superintendent of the county board of health the existence of any contagious or infectious disease, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not more than one hundred dollars, or by imprisonment in the county jail for not more than six months, or by both such fine and imprisonment, in the discretion of the court.

TENNESSEE.

[Acts of 1905, ch. 519.]

SEC. 1. Whenevor any case of smallpox, yellow fever, cholera, bubonic plague, typhus fevor, diphtheria, membranous croup, scarlet fever, or other communicable diseases exist (except it shall not embrace any venereal disease, such as gonorrhea or syphilis), or is even suspected to exist in any household, it shall be tho duty of the head of said household, or any other person in such household possessing knowledge of said facts, to immediately notify the municipal or county health authorities of the town or county wherein such disease or diseases exist or may be supposed to exist.

SEC. 2. Whenever any physician, surgeon, or practitioner of medicine shall know or suspect that any person or persons, whom they have been called to visit, or who has been brought to them for examination, or any other suspicious information received relative thereto, is or are infected, or even suspected, with any of the aforementioned diseases, ho shall, and it shall be his duty to, immediately notify the health authorities of the town or county in which said diseased person or persons are found.

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SEC. 11. It shall be the duty of each and every municipal or county board of health in this State, upon receiving information of the existence or suspected existence in their respective jurisdiction of any case of smallpox, cholera, yellow fever, scarlet fever, diphtheria, or other disease dangerous to the public health, to immediately notify the State board of health of the fact, and, in addition, on the first of each and every month make a written report and forward the same without delay to said board

of all communicable diseases occurring in their respective jurisdictions for the last month preceding, setting forth in said report in separate columns the age, color, and sex of the individual, name of each disease, number of cases, number of deaths, together with such other information as said State board of health may desire.

[Acts of 1911, ch. 10.]

SECTION 1. Be it enacted by the General Assembly of the State of Tennessee, that a person who, being a midwife, nurse, or other person having the care of an infant within the age of 2 weeks, neglects or omits to report immediately to the health officers or to a legally qualified practitioner of medicine of the city, town, or place where such child is being cared for, the fact that one or both eyes of such infant are inflamed or reddened whenever such shall be the case, or who applies any remedy therefor without the advice or except by the direction of such officer or physician, or neglects, refuses, or omits to comply with the above requirements shall be guilty of a misdemeanor.

TEXAS.

[Acts of 1911, ch. 95.]

Rule 1.—Every physician in the State of Texas shall report in writing or by an acknowledged telephone communication to the local health authority immediately after his or her first professional visit, each patient he or she shall have or suspect of suffering with any contagious disease, and if such disease is of a pestilential nature he shall notify the president of the State board of health at Austin by telegraph or telephone at State expense. * * *

Rule 2.—For the purpose of these regulations the phrase "local health authority" shall be held to designate the city or county health officer, or local board of health, within their respective jurisdictions.

Rule 3.—The phrase "contagious disease" as used in these regulations shall be held to include the following diseases, whether contagious or infectious, and as such shall be reported to all local health authorities and by said authorities reported in turn to the president of the State board of health: Asiatic cholera, bubonic plague, typhus fever, yellow fever, smallpox, scarlet fever (scarlatina), diphtheria (membranous croup), epidemic cerebrospinal meningitis, dengue, typhoid fever, epidemic dysentery, trachoma, tuberculosis, and anthrax.

Rule 4.—City and county health authorities shall keep a careful and accurate record of all cases of contagious diseases as reported to them, with the date, name, age, sex, race, location, and such other necessary data as may be prescribed by the State board of health. And they shall also make a monthly report of all contagious diseases, of which they may be cognizant, to the president of the State board of health before the fifth of the following month upon blank forms provided by the State board of health. The reports on tuborculosis are to be privately kept and are to be considered in the light of a confidential communication, not for the purpose of isolation, but with the object of education in sanitary precautions and to supply literature of the State board of health.

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Rule 22. Whenever any nurse, midwife, or other person not a legally qualified practitioner of medicine shall notice inflammation of the eyes or redness of the lids in a newborn child under his or her care, it shall be the duty of such person to report the same to the local health authority, or in his absence any reputable physician, within twelve hours of the time the disease is first noticed.

Rule 23.—Every hotel proprietor, keeper of a boarding house, or inn, and householder or head of family in a house wherein any case of reportable contagious disease (including tuberculosis) may occur shall report the same to the local health authority

within twelve hours of the time of his or her first knowledge of the nature of such disease unless previous notice has been given by the physician in attendance. * * *

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Any person who shall violate any of the rules, regulations, or provisions of the sanitary code of Texas, as herein set forth, shall be deemed guilty of a misdemeanor, and upon conviction shall be fined in any sum not less than ten dollars and not more than one thousand dollars.

UTAH.

[Compiled Laws, 1907.]

Sec. 1108. Every local board of health or health officer shall report to the secretary of the State board of health at such times as the State board may require. * * * It shall be the duty of the local health officer to make a monthly report to the State board of health, on or before the fifth day of each month, of all cases of scarlet fever, smallpox, diphtheria, membranous croup, typhoid fever, whooping cough, measles, chicken pox, pneumonia, and tuberculosis which have occurred within his jurisdiction during the previous month; and upon receipt of the notification of the existence of any case of either of said diseases in any family, a member of which is in attendance upon any public or private school, he must at once report the existence of such disease to the principal of the school so attended. * * *

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Sec. 1111. All physicians or other persons having knowledge of the existence of any contagious or infectious disease, or having reason to believe that any such disease exists, are hereby required to report the same forthwith to the local board of health.

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1113x11 (as amended by laws of 1911, ch. 75, sec. 1). It shall be the duty of every physician or other person caring for the sick in the State of Utah, to make a report to the local board of health immediately after such person becomes aware of the existence of any case of scarlet fever, diphtheria, membranous croup, whooping cough, smallpox, typhoid fever, measles, tuberculosis, Asiatic cholera, rubella (rotheln), chicken pox, typhus fever, plague, cerebro spinal meningitis, infantile paralysis, leprosy, or pneumonia, in his or her charge, and it shall be the duty of every person, owner, agent, manager, principal, or superintendent of any public or private institution, or dispensary, hotel, boarding house, or lodging house to make a report in like manner of any inmate, occupant, or boarder, suffering from any of the said infectious or contagious diseases; and in case such physician or other person shall fail to report in twenty-four hours, said person shall be deemed guilty of a misdemeanor.

Sec. 1113x27. It shall be the duty of every physician in the State, every superintendent of hospital or public institution in the State, to immediately report to the State board of health every case of tuberculosis which he is called upon to treat or which is in such hospital or public institution; each and every physician or superintendent shall make such reports as may be called for by the rules and regulations of the State board of health, and must comply with all rules and regulations made by said board to prevent the spread of such disease.

Any person violating any provision of this act shall be guilty of a misdemeanor.

[Acts of 1911, ch. 61.]

Section 1. It shall be the duty of every physician and every midwife attending a case of childbirth to report to the local board of health every case where the newly born child has inflammation of the eyes attended by a discharge therefrom. Such report to be made within six hours after the appearance of such disease. It shall be the duty of such physician or midwife to treat the eyes of the child so affected in accordance with the rules of the State board of health. Every physician and midwife failing to comply with the provisions of this act shall be guilty of a misdemeanor.

[Laws of 1911, ch. 90.]

SECTION 1. *Physicians and superintendents of hospitals to report cases.*—It shall be the duty of every physician in this State, every superintendent or manager of a hospital or public institution in this State, to immediately report to the local board of health, every case of venereal disease, which he is called upon to treat or which is in such hospital or public institution, and each and every physician, superintendent or manager of such hospital or institution shall make such reports as may be called for by the rules and regulations of the State boards of health of this State and must comply with all the rules and regulations made by said boards to prevent the spread of venereal diseases: *Provided,* That the report of such venereal disease shall not include the name of the person affected.

SEC. 2. *Rules and regulations.*—It shall be the duty of all boards of health to enact and enforce rules and regulations necessary to prevent the spread of venereal diseases.

SEC. 3. *Penalty.*—Any person violating any of the provisions of this act shall be guilty of a misdemeanor.

VERMONT.

[Public Statutes, 1906.]

SEC. 5446. The State board of health shall have power to designate a health officer of a town adjoining an unorganized town or gore as the health officer of such unorganized town or gore; and said health officer shall report to the secretary of said board every case of contagious disease mentioned in this chapter of which he has information or knowledge as existing in such unorganized town or gore. * * *

SEC. 5447. The head of a family in such unorganized town or gore in whose home there occurs a case of infectious or contagious disease dangerous to the public health shall immediately give notice to said health officer. A physician who knows or suspects that a person in such unorganized town or gore whom he has been called to attend is sick or has died of a communicable disease dangerous to the public health shall at once quarantine and report to said health officer the place where such cause exists, the name, degree of virulence, and cause or source of the disease. * * * The head of a family or a physician who fails to give reasonable notice to said health officer of the existence of such a disease shall be fined not more than fifty dollars nor less than ten dollars, with costs of prosecution.

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SEC. 5450. A physician who is consulted by a person subject to tuberculosis shall submit the name and address of such person to the secretary of the State board of health upon such blanks as it may furnish. * * *

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SEC. 5453. Each health officer shall report to the secretary of the State board of health, immediately after receiving information or knowledge thereof, every case of smallpox, varioloid, Asiatic cholera, typhus fever, or yellow fever within the jurisdiction of such local board. * * *

SEC. 5454. The head of a family in whose home there occurs a case of infectious or contagious disease dangerous to the public health shall immediately give notice thereof to the local health officer of the town in which he lives. A physician who knows or suspects that a person whom he has been called to attend is sick or has died of a communicable disease dangerous to the public health shall immediately quarantine and report to the health officer the place where such case exists, and the name, degree of virulence, and cause or source of the disease. * * *

SEC. 5455 (as amended by acts of 1910–11, ch. 217). A health officer shall, upon receiving notice of a case of infectious or contagious disease dangerous to the public health, investigate and ascertain, if possible, the source or cause of the disease, * * * and immediately report the facts to the secretary of the State board of health. When

a communicable disease prevails or becomes epidemic, said health officer shall make weekly reports concerning such disease or diseases to the secretary of the State board of health. * * *

VIRGINIA.

[Pollard's Code of 1904.]

SEC. 1713d. * * *.

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11. The State board of health may require any local board of health to furnish periodically to said State board such facts connected with vital statistics in its city, county, or town as said State board of health may prescribe.

12. The State board of health shall annually, on or before the first day of January in each year, make a written report to the governor upon the vital statistics and sanitary conditions and prospects of the State. * * *

[Acts, 1910, ch. 307.]

1. Every physician practicing in this Commonwealth who shall know or suspect that any person whom he or she is called upon to visit, or who comes to him or her for examination or treatment, is suffering from any infectious, contagious, communicable or dangerous disease shall make report in writing, on blanks to be furnished for that purpose by the State board of health, to the executive officer of the board of health of the county, town, or city in which such person may be located, over his or her own signature, stating the name of the disease, and the name, color, sex, and age of the person suffering therefrom, together with the street and number or such other sufficient designation of the house, room, or other place in which said person may be located, and such other information as may be deemed necessary by said health authorities.

2. The State board of health is hereby authorized to prepare and promulgate from time to time a list of diseases considered as infectious, contagious, communicable, or dangerous within the meaning of this act, and to prescribe the manner and time of the report called for by the preceding section.

3. For failure to comply with the provisions of this act the physician so failing shall be fined not less than one nor more than five dollars for each offense.

[Acts of 1910, ch. 340.]

SEC. 7. It shall be the duty of the local authorities of the cities, towns, and counties of the State to report weekly to the State board of health all cases of infectious, contagious, communicable, or dangerous diseases which have occurred under their jurisdiction, except that it shall be their duty to report immediately any case or cases of smallpox, yellow fever, cholera, typhus fever, or bubonic plague that may occur within their jurisdiction. * * *

WASHINGTON.

[Remington & Ballinger's Annotated Codes and Statutes, 1910.]

SEC. 5407. It shall be the duty of the local board of health, health authorities, or officials, and of physicians in localities where there are no local health authorities or officials, to report to the State board of health, promptly upon discovery thereof, the existence of any one of the following diseases which may come under their observation, to wit: Asiatic cholera, yellow fever, smallpox, scarlet fever, diphtheria, typhus, typhoid fever, bubonic plague or leprosy, and of such other contagious or infectious diseases as the State board may from time to time specify. * * *

SEC. 5536. It shall be the duty of every health officer appointed under the provisions of this chapter, or by the provisions of special charters, upon the appearance of smallpox, diphtheria, scarlet fever, Asiatic cholera, or dangerous contagious disease

in the town or city under his supervision, * * * to make full report thereof to the board of health of which he is an executive officer, and also to the State board of health. * * * The term "dangerous contagious disease" as used in this chapter shall be construed and understood to mean such diseases as the State board of health shall designate as contagious and dangerous to the public health. * * *

SEC. 5540. It shall be the duty of every health officer appointed under the provisions of this chapter * * * to report to the State board of health any information he may receive of any case of smallpox, cholera, yellow fever, or typhus fever within three days after receiving any notification or information of the existence of such disease; and any health officer * * * who shall fail or neglect to comply with the provisions of this section shall be liable to a penalty of not less than ten dollars nor more than one hundred dollars for each day of such neglect or refusal to comply with the provisions of this section.

SEC. 5544. * * * All city health officers except those of cities of the first class shall report immediately to the State board of health every new outbreak of any contagious or infectious disease and shall make weekly reports to the county health officer of all contagious or infectious diseases occurring within the city.

It shall be the duty of all health officers, upon the appearance of any dangerous, contagious, or infectious diseases within their jurisdiction, * * * to make a full report thereof, as required above. * * *

SEC. 5545. Whenever any physician shall attend any person sick with any dangerous, contagious, or infectious disease, or with any diseases required by the State board of health to be reported, he shall, within twenty-four hours, give notice thereof to the health officer within whose jurisdiction such sick person may then be.

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SEC. 5547. The term "dangerous, contagious, or infectious disease," as used in this chapter shall be construed and understood to mean such disease or diseases as the State board of health shall designate as contagious or infectious and dangerous to the public health.

SEC. 5548. Any health officer who shall refuse or neglect * * * to make prompt and accurate reports to the county health officer or to the State board of health may be removed as health officer by the State board of health, and shall not again be reappointed except with the consent of the State board of health.

* * * Any physician who shall refuse or neglect to report to the proper health officer within twelve hours after first attending any case of contagious or infectious disease or any disease required by the State board of health to be reported, or any case suspicious of being one of such diseases, shall be guilty of a misdemeanor, and upon conviction shall be fined not less than ten dollars nor more than two hundred dollars for each case that is not reported.

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SEC. 5550. All practicing physicians in cities of the first and second class in said State are hereby required to report to the local boards of health of such cities, in writing, the name, age, sex, occupation, and residence of every person having tuberculosis who has been attended by, or who has come under the observation of such physician for the first time, within five days of such time.

SEC. 5551. All local boards of health of cities of the first and second class in this State are hereby required to receive and keep a permanent record of the reports required by section five thousand five hundred and fifty to be made to them; such records shall not be open to public inspection, but shall be submitted to the proper inspection of other local and State boards of health alone, and such records shall not be published nor made public.

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SEC. 5553. Any practicing physician who shall wilfully fail to comply with the provisions of section five thousand five hundred and fifty shall be guilty of a misdemeanor,

and on conviction thereof may be fined for the first offense not exceeding five dollars and for any subsequent offense not exceeding one hundred dollars.

WEST VIRGINIA.

[Supplement to Code, 1909.]

SEC. 4383. * * * The said local board of health shall make and establish for their county, or for any district, or place therein, such sanitary regulations or rules as they may deem proper to prevent the outbreak and spread of cholera, smallpox, scarlet fever, diphtheria, tuberculosis, and other endemic, epidomic, infectious, and contagious diseases, * * *. It shall be the duty of every practicing physician in any county in which there is such local board of health to report promptly all or any diseases of the above-named character under treatment by him, and said local board shall once at least in every three months report to the State board of health the character of all such infectious, contagious, and epidemic diseases, the number of persons reported as infected with such diseases, naming the same, the action taken by the local board to arrest the progress of every such disease and the visible effects, if any, of such action.

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WISCONSIN.

[Annotated Statutes, 1898.]

SEC. 925—111b. It shall be the duty of every physician practicing in any city which has adopted this chapter (cities under general law) to report in writing to the commissioner of public health every patient ho shall have who is sick with smallpox, scarlet fever, diphtheria, typhoid fever, Asiatic cholera, or any other dangerous contagious disease, within twenty-four hours after he shall ascertain or suspect the nature of such disease. The reports shall be in such form as may be prescribed by the State board of health, and shall state the name, sex, age, and placo of residence of the person whose sickness is reported, the nature of the disease and such additional facts as said board may prescribe. Any practicing physician who shall refuse or neglect to perform the duties required of him by this section, or who shall make a false return of the facts required, shall be punished by a fine not less than twenty-five dollars nor more than one hundred dollars for each offense, or by imprisonment in the county jail for a period not exceeding sixty days, or by both fine and imprisonment.

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SEC. 1409a-2. (Added by acts of 1909, ch. 59.) * * * Should one or both eyes of an infant become inflamed, swollen, and red, and show an unnatural discharge at any time within two weeks after its birth, nurse, parents, or other attendant having charge of such infant shall report in writing, within six hours thereafter, to the board of health of the city, incorporated village, or town in which the parents of the infant reside the fact that such inflammation, swelling, redness, or unnatural discharge exists.

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SEC. 1412. It shall be the duty of every health officer, chosen under the provisions of the preceding section, or under any village or city charter, upon the appearance of any dangerous contagious disease in the territory within the jurisdiction of the board of which he is a member, to immediately investigate all the circumstances attendant upon the appearance of such disease, mako a full report to such board, and also to the State board of health. * * *

SEC. 1412a (as amended by Acts of 1909, ch. 85). Whenever any physician practicing in this State shall know or have good reason to believe that any person whom he treats or visits is sick with a dangerous, contagious, or infectious disease, he shall, immediately after obtaining such knowledge or forming such belief, give notice thereof in writing, stating the name, sex, age, and place of residence of person whose sickness is

reported, the nature of the disease and such additional facts as said board may prescribe to the board of health of the town, city, or village in which such sick person shall then be, and if he shall fail to so do for a period of twenty-four hours thereafter, he shall forfeit not less than five nor more than twenty-five dollars for each day of such failure after the expiration of said twenty-four hours, provided such notice may be sent by mail, or, except in cities, may be given to, or left at the residence of, any member of the board of health. When any person is sick with any such disease, and no physician is in attendance upon such person, the provisions of this section shall apply to the responsible head of the family of which he is a member, or if the sick person is not a member of the family occupying the house or building in which he may be, the person in charge thereof. * * * .

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SEC. 1416—1 (Acts of 1905, ch. 192, as amended by Acts of 1907, ch. 93). It shall be the duty of every physician to report to the department of health in every town, incorporated village, or city, in writing, the full name, age, and address of every person suffering from any one of the infectious or contagious diseases following, to wit: Measles, smallpox, diphtheria (membranous croup), scarlet fever (scarlatina), typhoid fever, tuberculosis (of any organ), rubella (rotheln), chicken pox, typhus fever, plague, erysipelas, Asiatic cholera, whooping cough, cerebro-spinal meningitis, yellow fever; and it shall be the duty of every person, owner, agent, manager, principal, or superintendent of any public or private institution or dispensary, hotel, boarding or lodging house, in any such town, incorporated village, or city to make a report in like manner and form of any inmate, occupant, or boarder suffering from any of the said infectious or contagious diseases.

* * * * * * *

SEC. 1416—3 (amended by Acts of 1907, ch. 93). It shall be the duty of every person having knowledge of the existence of any person afflicted with any one of the following infectious or contagious diseases, to wit: Measles, diphtheria (membranous croup), scarlet fever, typhoid fever, tuberculosis, smallpox, Asiatic cholera, typhus fever, rubella (rotheln), plague, and whooping cough, or has reason to believe that any person is so afflicted, to at once report to the health department of such town, incorporated village, or city all facts in regard to the case. * * *

SEC. 1416—4 (amended by Acts of 1907, ch. 93). It shall be the duty of every physician, or person, or owner, agent, manager, principal, or superintendent of each and every public or private institution or dispensary, hotel, boarding or lodging house, in any such city to report to the department of health thereof, in writing, or to cause such report to be made by some proper and competent person, the name, age, sex, occupation, aud latest address of every person afflicted with tuberculosis, who is in their care, or who has come under their observation, within one week of such time.

WYOMING.

[Compiled statutes, 1910.]

SEC. 2934. * * * It shall be their [State board of health] duty to investigate regarding all contagious and infectious diseases that are a menace to public safety, and they shall collect such information in respect to these matters as may be useful in the discharge of their duties and contribute to the promotion of health and security of life in this State.

* * * * * * *

SEC. 2936. * * * When in any county a case of smallpox, cholera, typhoid fever, scarlet fever, diphtheria, or other epidemic or contagions or infectious disease is known to exist, it shall be the duty of the county health officer of such county to immediately notify tho secretary of the State board of health of the existence of the same, with such facts as to its cause and continuance as may then be known.

* * * * * * *

SEC. 2942. It shall be the duty of every practicing or licensed physician in the State of Wyoming to report immediately to the secretary of the State board of health and county health officer, by telegram or telephone, or in the most expeditious manner, every case of smallpox, cholera, scarlet fever, diphtheria, or contagious or infectious disease that is a menace to public health, and such telegram shall be paid for out of the funds provided for the expenses of said State board of health.

SEC. 2943. Any practicing or licensed physician who shall fail to report to said secretary any such case in the manner provided in the preceding section, or shall willfully make any false report regarding any such case, shall be guilty of a misdemeanor, and upon conviction thereof shall be fined in the sum of not less than one hundred dollars and not more than one thousand dollars, or imprisoned in the county jail not less than six months nor more than one year.

NEW YORK.

[Laws of 1911, ch. 258.][a]

SEC. 1. Article four of the labor law, entitled "An act relating to labor, constituting chapter thirty-one of the consolidated laws," is amended by the addition of a new section numbered fifty-eight, to read as follows:

§ 58. *Industrial poisonings to be reported.*—1. Every medical practitioner attending on or called in to visit a patient whom he believes to be suffering from poisoning from lead, phosphorus, arsenic or mercury or their compounds, or from anthrax, or from compressed air illness, contracted as the result of the nature of the patient's employment, shall send to the commissioner of labor a notice stating the name and full postal address and place of employment of the patient and the disease from which, in the opinion of the medical practitioner, the patient is suffering, with such other and further information as may be required by the said commissioner.

2. If any medical practitioner, when required by this section to send a notice, fails forthwith to send the same, he shall be liable to a fine not exceeding ten dollars.

3. It shall be the duty of the commissioner of labor to enforce the provisions of this section, and he may call upon the State and local boards of health for assistance.

SEC. 2. This act shall take effect September first, nineteen hundred and eleven.

[a] Copy of law received too late for insertion in proper order.

SOME COURT DECISIONS HAVING A BEARING ON THE NOTIFICATION OF DISEASE.[1]

IOWA.

* * * * * * *

2. The statute requires the collection of statistics pertaining to the population of the State and the health of the people which may impart information useful in the enactment of laws and valuable to science and the medical profession, to whom the people look for remedies for disease and for means tending to preserve health. The objects of the statutes are within the authority of the State, and may be attained in the exercise of its police power. Similar objects are contemplated by statutes requiring a census to be periodically taken, the constitutionality of which we have never heard questioned.

3. We need not inquire whether the requirements of the statute are unjust or oppressive. These are matters for the consideration of the legislative part of the Government. We may observe that it is difficult to discover oppression or injustice in requiring the medical profession to make known to the world statistics which may promote and are promoting the public health.

4. One ground of the demurrer is that defendant, under the statute, is required to do that which it is impossible for him to perform. The law requires of no man impossibilities. If the information sought from defendant could not have been obtained by him in the bona fide exercise of reasonable diligence, the law will not punish him for not imparting it. A physician should honestly endeavor to obtain and report all information required by the regulations of the statute and the board of health. This is his duty as a surgeon and is imposed as an obligation by the ethics of the useful and honorable profession of which he is a member. * * * (Robinson, Clerk, etc., *v.* Hamilton, 14 N. W. Rep., 202; 60 Iowa, 134.)

MICHIGAN.

* * * It is true that the evidence showed that a week or ten days after these children had been pronounced by the defendant as suffering from diphtheria, he stated to the health officer, Mr. John, as the health officer testifies, that "they had diphtheria at Lotharias' and Heft's," and that immediately after the board of health took steps to prevent its spread. Yet this was not the notice required by the statute, which is to be in writing, giving the name, place of residence, and nature of the disease. Upon this branch of the case the court directed the jury that it was a question for them to determine whether the defendant failed to report the cases within a reasonable time after he discovered the existence of the disease, and that in cases like diphtheria, where the disease is virulent and rapid in its action, eight days were not a reasonable time. There was no error in this charge, and we think the court would have been justified in saying that no notice was given at all, as required by the statute. * * * (People *v.* Brady, 51 N. W. Rep., 537; 90 Mich., 459.)

[1] No attempt has been made to compile all court decisions on the subject, but those at hand have been inserted because of their possible interest.

The ordinance of the city of Bridgeport requiring every physician having any patient within the city limits sick with smallpox or varioloid, or other contagious or pestilential disease, to report the fact to the mayor or to the clerk of the board of health, together with the name of the patient and the street and number of the house where treated, under a penalty not exceeding $50 for each violation of the ordinance was held to be valid and not conflicting with the constitutional rights of the citizens, the legislature having power to authorize its enactment by the common council.

"The unequality of burden of which the defendant complains is only in seeming. Persons offering their services to the public as healers of disease and requiring pecuniary compensation therefor thereby assert their ability to detect the presence of it when the great mass of the people can not. The people accede to the truth of their assertion, and in the matter of life surrender themselves to their keeping. Of course an ordinance in the interest of life must detect the presence of a fatal contagious disease at the earliest possible moment. Therefore with impartial action it compels that member of the community who is the first to have sight and knowledge of it to give note of warning to others from whom its presence is hidden. It would be idle to require, indeed there would be danger in accepting, this service from those who can not see or do not know. The burden is made to rest upon every member of the only class which is in a condition to contribute anything to the accomplishment of the purpose of the ordinance." (State *v.* Wordin, 14 Atl. Rep., 801; 56 Conn., 216.)

LIST OF PUBLIC HEALTH BULLETINS.

The following is a list of the Public Health Bulletins that have been issued:

*1. Report on Trichinæ and Trichinosis. By W. C. W. Glazier. 1881. 212 pages. 87 il. 1 map. Paper. Senate Executive Document No. 9, Forty-sixth Congress, third session. Out of print.

*2. Report on the Etiology and Prevention of Yellow Fever. By George M. Sternberg. 1890. 271 pages. 21 pl. 20 il. Cloth. Out of print.

3. Mortality Statistics in the United States for the year ending December 31, 1897. From Annual Report Marine-Hospital Service, 1898. 24 pages. Paper.

4. Yellow Fever: Its Nature, Diagnosis, Treatment, and Prophylaxis and Quarantine Regulations Relating thereto. By officers of the Marine-Hospital Service. Reprint from Annual Report Marine-Hospital Service, 1898. 176 pages. 1 il. Paper.

*5. Shipment of Merchandise from a Town Infected with Yellow Fever. By H. R. Carter. 1899. 15 pages. Paper. Out of print.

6. Report of Commission of Medical Officers Detailed by Authority of the President to Investigate the Cause of Yellow Fever. By Eugene Wasdin and H. D. Geddings. July, 1899. 98 pages. 26 charts. 2 il. Paper.

*7. The Bubonic Plague. By Walter Wyman. January, 1900. 50 pages. Paper. Superintendent of Documents, 5 cents.

*8. Report of Commission Appointed by the Secretary of the Treasury for the Investigation of Plague in San Francisco. By Prof. Simon Flexner, Prof. F. G. Novy, and Prof. L. F. Barker. January 23, 1901. 23 pages. 1 map. Paper. Out of print.

9*. Report Relating to the Origin and Prevalence of Leprosy in the United States. By a Commission of Medical Officers of the U. S. Marine-Hospital Service. 1902. 119 pages. 25 il. Paper. Senate Document No. 269, Fifty-seventh Congress, first session. Superintendent of Documents. Cloth, $1.00.

*10. Plague Conference. Containing a copy of the address of the chairman, and resolutions passed by a conference called in accordance with requests from a number of State Boards of Health, and under authority of section 7, act of Congress approved July 1, 1902, to consider the plague situation. Reprint from P. H. R. No. 4, Vol. XVIII, January 23, 1903. 9 pages. And February 6, 1903. 41 pages. Paper. Out of print.

11. Transactions of the First Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. June, 1903. 120 pages. Cloth.

12. Transactions of the Second Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. June, 1904. 95 pages. Cloth.

13. The Public Health and Marine-Hospital Service of the United States. A Brief History. Prepared for the Louisiana Purchase Exposition. December, 1904. 16 pages. Paper.

*14. Sanatorium for Consumptives, Fort Stanton, N. Mex. By P. M. Carrington. Reprint from Annual Report Public Health and Marine-Hospital Service, 1904. 19 pages. Paper. Out of print.

* Exhausted and not for distribution.

15. Transactions of the Third Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. May, 1905. 52 pages. Cloth.
16. How to Prevent Yellow Fever—No Mosquitoes, No Yellow Fever. By Walter Wyman. July 31, 1905. 3 pages. Circular.
17. Transactions of the Fourth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. May, 1906. 75 pages. Cloth.
18. Transactions of the Fifth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. May, 1907. 47 pages. Cloth.
19. Trachoma, Its Character and Effects. By Taliaferro Clark and J. W. Schereschewsky. 1907. 34 pages. 6 il. Paper.
*20. The Public Health and Marine-Hospital Service of the United States. A Brief History. Prepared for the Jamestown Ter-Centennial Exposition. 1907. 12 pages. Paper. Out of print.
21. Transactions of the Sixth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. April, 1908. 79 pages. Cloth.
*22. The Present Pandemic of Plague. By J. M. Eager. 1908. 30 pages. Paper. Out of print.
23. Pellagra—A Precis. By C. H. Lavinder. July 24, 1908. 22 pages. 1 il. Paper.
24. The Marine-Hospital Sanatorium, Fort Stanton, N. Mex. Prepared for the International Congress on Tuberculosis, held in Washington, September, 1908. 32 il. 56 pages. Paper.
*25. Hookworm Disease. Reprint from Annual Report P. H. and M. H. S., 1908. 5 pages. Paper. Out of print.
26. Studies upon Leprosy.
    I. The Present Status of the Leprosy Problem in Hawaii.
    II. The Reaction of Lepers to Moro's "Percutaneous" Test.
    III. A Note Upon the Possibility of the Mosquito Acting in the Transmission of Leprosy. By W. R. Brinckerhoff. 1908. Investigations made in accordance with the act of Congress approved March 3, 1905. 24 pages. Paper.
27. Studies upon Leprosy.
    IV. Upon the Utility of the Examination of the Nose and the Nasal Secretions for the Detection of Incipient Cases of Leprosy. By W. R. Brinckerhoff and W. L. Moore. 1909. Investigations made in accordance with the act of Congress approved March 3, 1905. 29 pages. Paper.
28. Studies upon Leprosy.
    V. A Report upon the Treatment of Six Cases of Leprosy with Nastine (Deycke). By W. R. Brinckerhoff and J. T. Wayson, Honolulu, T. H.
    VI. Leprosy in the United States of America in 1909. By W. R. Brinckerhoff. 1909. Investigations made in accordance with the Act of Congress approved March 3, 1905. 25 pages. Paper.
29. The Prevalence of Rabies in the United States. By J. W. Kerr and A. M. Stimson. 1909. 16 pages. Paper.
30. The Rat and its Relation to the Public Health. By various authors. 1910. 254 pages. 60 figs. 6pls. Paper.
    1. Introduction. By Walter Wyman.
    2. Natural History of the Rat. By D. E. Lantz.
    3. Plague Infection in Rats. By G. W. McCoy.

* Exhausted and not for distribution.

30. The Rat and its Relation to the Public Health—Continued.
    4. Rat Leprosy. By W. R. Brinckerhoff.
    5. Bacterial Diseases of the Rat other than Plague. By D. H. Currie.
    6. Organic Diseases of the Rat. By G. W. McCoy.
    7. Ecto Parasites of the Rat. By N. Banks.
    8. Intestinal Parasites of Rats and Mice in their Relation to Diseases of Man. By C. W. Stiles.
    9. Rodents in Relation to the Transmission of Bubonic Plague. By Rupert Blue.
    10. Rodent Extermination. Rats and Mice. By W. C. Rucker.
    11. Natural Enemies of Rats. By D. E. Lantz.
    12. Rat-Proofing as an Antiplague Measure. By R. H. Creel.
    13. Inefficiency of Bacterial Viruses in the Extermination of Rats. By M. J. Rosenau.
    14. Plague Eradication in Cities by Section Extermination of Rats and General Rat-Proofing. By Victor G. Heiser.
    15. The Rat in Relation to Shipping. By W. C. Hobdy.
    16. The Rat as an Economic Factor. By D. E. Lantz.
    17. The Rat in Relation to International Sanitation. By J. W. Kerr.
31. Transactions of the Seventh Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. June, 1909. 86 pages. Cloth.
32. Hookworm Disease (or Ground-Itch Anemia), its Nature, Treatment, and Prevention. By Prof. C. W. Stiles. 1910. 40 pages. Paper.
33. Studies upon Leprosy. 1910. 25 pages. Paper.
    VII. A Statistical Study of an Endemic Focus of Leprosy. By W. R. Brinckerhoff and A. C. Reinecke.
    VIII. A Palliative Treatment for Leprous Rhinitis. By J. T. Wayson and A. C. Reinecke.
34. Maritime Quarantine. By L. E. Cofer. 1910. 25 figs. 64 pages. Paper. Appendix: Disinfectants Authorized by United States Quarantine Regulations and the Proper Method of Generating and Using Same.
35. The Relation of Climate to the Treatment of Pulmonary Tuberculosis. By F. C. Smith. 1910. 17 pages. Paper.
36. Tuberculosis: Its Nature and Prevention. By F. C. Smith. 1910. 12 pages. 1 plate. Paper.
37. The Sanitary Privy: Its Purpose and Construction. By Prof. C. W. Stiles. 1910. 24 pages. 12 figs. Paper.
38. General Observations on the Bionomics of the Rodent and Human Fleas. By M. B. Mitzmain. 1910. 34 pages. Paper.
39. Studies upon Leprosy. September, 1910. 50 pages. Paper.
    IX. Mosquitoes in Relation to the Transmission of Leprosy.
    X. Flies in Relation to the Transmission of Leprosy. By D. H. Currie.
    XI. Heredity Versus Environment in Leprosy. By H. T. Hollmann.
40. Transactions of the Eighth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service. November, 1910. 101 pages. Paper.
41. Studies upon Leprosy. November, 1910. 32 pages. Paper.
    XII. Notes on the Study of Histories of Lepers from the Standpoint of Transmission. By D. H. Currie.
    XIII. A Contribution to the Study of Rat Leprosy. By D. H. Currie and H. T. Hollmann.

42. Disinfectants. Their Use and Application in the Prevention of Communicable Diseases. By T. B. McClintic. December, 1910.
43. I. Studies upon Plague in Ground Squirrels. II. A Plague-like Disease of Rodents. By George W. McCoy. February, 1911. 71 pages. 7 pls. Paper.
44. Acute Anterior Poliomyelitis (Infantile Paralysis). By Wade H. Frost. February, 1911. 52 pages. Paper.
45. A Digest of the Laws and Regulations of the Various States Relating to the Reporting of Cases of Sickness. By John W. Trask.

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TREASURY DEPARTMENT

Public Health and Marine-Hospital Service of the United States

PUBLIC HEALTH BULLETIN No. 46

SEPTEMBER, 1911

TRANSACTIONS OF THE

Ninth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service

SAN FRANCISCO, CAL.

JUNE 24, 1911

WASHINGTON
GOVERNMENT PRINTING OFFICE
1911

CONTENTS.

APPENDIX.

LETTER CALLING NINTH ANNUAL CONFERENCE.

The following letter was addressed to the health authorities of each State, Territory, and the District of Columbia:

TREASURY DEPARTMENT,
PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
Washington, February 27, 1911.

DEAR DOCTOR: I have the honor to inform you that the Ninth Annual Conference of State and Territorial Health Authorities with the Public Health and Marine-Hospital Service will be held at the St. Francis Hotel, San Francisco, Cal., June 24, 1911, at 10 a. m. In accordance with the act approved July 1, 1902, each State and Territory will be entitled to one delegate, and it is respectfully urged that there be full representation, as important matters in relation to morbidity statistics, transportation of the dead, antiplague measures, and other subjects will be brought before the conference.

I have to request that I be informed in advance of the name of the delegate who will represent your health organization.

Respectfully,

WALTER WYMAN,
Surgeon General.

Ninth Annual Conference of State and Territorial Health Officers with the United States Public Health and Marine-Hospital Service.

TRANSACTIONS.

MORNING SESSION.

June 24, 1911.

The Ninth Annual Conference of State and Territorial Health Authorities with the Public Health and Marine-Hospital Service was called to order at the St. Francis Hotel, San Francisco, Cal., by Asst. Surg. Gen. J. W. Kerr at 10.20 a. m., the following being present:

Public Health and Marine-Hospital Service: Asst. Surg. Gen. J. W. Kerr; Surg. Rupert Blue; Passed Asst. Surgs. F. E. Trotter, M. W. Glover, G. W. McCoy, Hugh de Valin, R. E. Ebersole, and Prof. Reid Hunt; Asst. Surg. H. E. Hasseltine, and Acting Asst. Surg. G. M. Converse.

Arizona: Dr. E. S. Godfrey.

California: Dr. Martin Regensburger, Dr. James H. Parkinson, and Dr. William F. Snow.

Idaho: Dr. George E. Hyde.

Kansas: Dr. S. J. Crumbine.

Maryland: Dr. J. S. Fulton.

Minnesota: Dr. H. M. Bracken.

Montana: Dr. T. D. Tuttle.

Massachusetts: Dr. Mark W. Richardson.

Ohio: Dr. C. O. Probst and Dr. Oscar Hazencamp.

Oregon: Dr. Calvin S. White.

Oklahoma: Dr. J. C. Mahr.

Rhode Island: Dr. Gardner T. Swartz and Dr. Rufus Darrah.

Washington: Dr. Elmer E. Heg.

Unofficial guests: J. F. Leinen, assistant to secretary California Board of Health; G. H. Leslie, statistician California Board of Health; Prof. J. W. Ritchie, Williamsburg, Va.; Dr. N. K. Foster, ex-secretary California State Board of Health; and Dr. Roger Lee, Boston.

Dr. J. W. Kerr. In the absence of the Surgeon General, it becomes my duty to call to order this the Ninth Annual Conference of State

and Territorial Health Authorities with the Public Health and Marine-Hospital Service. It is a matter of great regret to me that the Surgeon General was unable to be present, but he was detained at the last moment by official matters of great urgency. On account of his unavoidable absence he desired me to express his regret, and addressed a letter to the conference which I shall ask Dr. Blue to read.

Dr. Blue thereupon read the following letter:

To the members of the Conference of State and Territorial Health Authorities with the Public Health and Marine-Hospital Service, San Francisco, Cal.

GENTLEMEN: For the first time since the enactment of the law of 1902 calling for these conferences, I am unable to meet with you. Until recently I had expected to join you in San Francisco and receive from you personally and collectively the stimulation for further endeavor in the matter of public health, and to convey to you such information as might seem proper concerning public-health matters which come under the purview of the Public Health and Marine-Hospital Service. Recently, however, official matters of great urgency and importance have arisen, particularly with reference to the personnel bill of the service, and other matters, which make it imperative that I should not be absent from Washington the length of time which a trip to the Pacific coast would require. When arrangements were made for holding this conference on the Pacific coast, there was no thought by me of a special session of Congress, or that any other matters would probably interfere with my being present. I will add that, within the last day or two, the cholera situation in Italy and the arrival of a cholera patient at the New York Quarantine Station make it impracticable for me to leave my official station. I have therefore requested that Asst. Surg. Gen. J. W. Kerr, with whom you are all acquainted, should represent me at this conference, and I trust that, in addition to the interesting discussions which you will hold, the visits to the several fields of operation in San Francisco and vicinity, such as the quarantine station on Angel Island, the immigration station, the Federal plague laboratory, and particularly the inspection of the field work of the service in the eradication of plague-infected squirrels, will all be interesting and profitable.

Dr. Kerr will outline to you some of the more important incidents connected with the public-health work by the service during the past year. It is expected that the officers on duty in San Francisco will also be present and will take pleasure in explaining the scope and character of their work. Features of the service work in California are so important that later, after the adjournment of Congress, and if epidemic conditions permit, it is my intention to visit San Francisco and vicinity, and to make the same observations which you are about to make. In the meantime, Dr. Kerr will report to me such facts of interest and importance as may seem desirable to you to comment upon.

Dr. J. W. KERR. It is my pleasure to welcome so many delegates and guests, some of whom have attended practically all previous conferences convened under the law of July 1, 1902. When it was decided that this conference should be held in San Francisco, I was particularly pleased at the prospect of again visiting this city where my first official duties were performed, and where I first had opportunity of becoming acquainted with plague and the practical measures necessary for its prevention. San Francisco in that day was a goodly city, but since that time two notable improvements

have been brought about—one, the physical transformation of the city following the great fire of 1906, and the other the changed and advanced attitude of the people as citizens with respect to the plague situation and the necessity of improved sanitation for its control. The unfortunate attitude of a decade ago has given place to a wise policy of cooperation, and whereas there was lack of cooperation then there is now complete understanding and cordiality. As a result much has been accomplished for the improvement of sanitary conditions. Plague has been eradicated from the city, and these things have been brought about as a result of the hearty cooperation of the local, State, and Federal health agencies. This latter is perhaps the chief cause of pleasure in holding this conference in San Francisco.

This is one of the most important American seaports, both from economic and sanitary standpoints, and it is here that a great deal of work has been accomplished by the service.

During the day opportunity will be given the delegates and guests of the conference to inspect the service operations at this port, and it is hoped that a favorable idea will be gained of their value, not only to the Pacific coast but to the country as a whole.

The State of California, as previously stated, has taken a very active part in these measures for the improvement of sanitary conditions. The State board of health was anxious that the health authorities of other States and Territories should become familiar with the work done, and it was partly in response to an invitation of the board that this conference is being held in California. It will be a pleasure, therefore, to hear a few words of welcome from Dr. Martin Regensburger, president of the State board of health.

Dr. Regensburger. I wish to state that Gov. Johnson has sent word that he would be unable to be present to-day, and I was asked to represent him. The governor is right with us on this whole situation. He knows that for the past 10 years the eyes of the different State boards of health have been upon us, and he is glad to have you come here and see what we are doing. Dr. Foster, our former secretary, has assured us that everything is being done and will be done to eradicate plague. The work that has been done here for the eradication of plague has been gigantic. San Francisco 10 years ago was a plague-ridden city; 4 to 5 per cent of the rats caught were plague rats, whereas within the last three or four years there have been no plague rats in San Francisco. This is due to the efficiency of the work of the Federal authorities. I wish to say that I do not think that any of you know the work that has been done by the Federal authorities in California and San Francisco. If any of you had come in contact with them in the way that we have, I think that

you would very much appreciate their work. There has never been any friction between the present State board of health and the Federal authorities. There has always been harmony. As Dr. Kerr has stated, the former State Board of Health of California was antagonistic to anything relating to plague and denied its existence. The first question that Gov. Pardee in appointing me asked me was, "Do you believe that there is plague in California?" I said, "Why, certainly," and he replied that he did not want any man on this board who did not believe in plague. I wish that you could remain here longer in order to get an idea of what not only San Francisco but California is doing. Dr. Blue has arranged a trip for you to-morrow to Contra Costa County, and you will be shown the gigantic work performed by the Public Health and Marine-Hospital Service.

In behalf of the people of California and the governor, I welcome you and wish that you may remain with us a long while, in order that you may become acquainted with California and the Californians.

Dr. Kerr. The Surgeon General desired me to outline briefly certain matters of importance that have engaged the attention of the service generally since the last conference. There has been an absence of the prevalence of all the major quarantinable diseases, except smallpox. This disease is unfortunately too prevalent, reports having been received of about 30,352 cases occurring in 37 States and the District of Columbia during 1910. On account of conditions in Alaska and because of the occurrence of smallpox in the Northwestern States, interstate quarantine regulations were put in practice requiring vaccination of all unvaccinated persons leaving continental ports for the District of Alaska. Previous experience had shown that the introduction of the infection into Alaska was followed by disastrous results, and it was with the view to preventing such results during the present season that this requirement was made.

An important matter since the last conference was the presence of cholera in Europe. As you all know, this disease has been gradually approaching our shores for the last five years. It has spread throughout the Orient and to some extent over Europe. Last year the disease was severe in Russia and Italy, a considerable number of cases having appeared in the latter country. The great danger of the introduction of cholera into the United States was realized and lines of defense were established as follows: First, inspections of ships and passengers and detention of emigrants at foreign ports for five full days prior to sailing; second, sanitary supervision of passengers en route by ships' surgeons under special instructions; third, medical inspections on arrival at domestic quarantine stations, and, where indicated, microscopic examinations of the dejecta of patients; fourth, special inspections at immigration stations for the

detention of mild or previously unrecognized cases of cholera; and fifth, the notification of State health authorities regarding the final destination of immigrants. Although the first four lines of defense mentioned were more complete than had ever been maintained before, it was thought that notification regarding the destination of immigrants was a wise additional precaution in view of the possible danger of bacillus carriers. By this means also State and local health authorities could be kept in touch with the situation, and in case of the occurrence of any suspicious outbreak in any part of the United States the service was prepared to send officers at a moment's notice who would cooperate with the States in making a final diagnosis.

It was realized that in some localities it would be difficult, if not impossible, for local authorities to maintain adequate surveillance over arriving aliens, nevertheless it was thought that with such information at hand, and in the event of the death of such persons, the local health authorities would be in position to verify the statements contained in the death certificate rendered. Two or three suspicious cases were reported in different parts of the country but fortunately on investigation they were proven not to be cholera.

Cholera serum has been secured and investigations of the disease taken up in the Hygienic Laboratory, and the bureau is prepared to send officers expert in the diagnosis of cholera to any part of the United States upon telegraphic notice from the health authorities. Since leaving Washington I understand that two ships have arrived in New York with cholera cases aboard, and that is one of the reasons why the Surgeon General was not able to be present at this conference. We must not forget that the danger of cholera to this country is probably greater now than it has ever been in the past 25 years. The cholera situation in Europe is serious, and it will be necessary for every health authority to be on the alert to guard against the disease during the coming summer.

A number of other important matters have engaged the attention of the service during the year, but time will permit of mention of only a few of them.

You were all interested in securing the establishment of the leprosy-investigation station in Hawaii. Great progress has been made there during the year in studies of leprosy. The bacillus has been grown on artificial media and the disease reproduced in monkeys. Important studies have been made as to the rôle of flies and mosquitoes in the transmission of the disease, and there has been some encouragement following treatment with newly prepared preparations.

Studies have been made in the Hygienic Laboratory of measles, and by means of blood inoculations the disease has been reproduced in monkeys and transferred from one monkey to another.

Investigations of typhoid fever have been conducted in different parts of the country, at Huntsville, Ala., Omaha, Nebr., Williamson, W. Va., Chicago, Ill., and other localities on the Great Lakes. In these latter, which are intended to include all of the Lakes, the studies have been made with the view to determining the influence of pollution of those waters on the incidence of typhoid fever in lake cities and towns. Passed Asst. Surg. A. J. McLaughlin has completed a sanitary survey of Lake Erie and the Niagara River, and the results are contained in Hygienic Laboratory Bulletin No. 77.

The bureau is cooperating with the State Board of Health of Washington in the investigation of a typhoid situation in the Yakima Valley, and arrangements have been made to make extensive studies of rural typhoid in cooperation with the State Board of Health of Virginia. It is felt that, from the public-health standpoint, research and administrative action for the prevention of typhoid fever are the most important matters that can engage the attention of health officials generally.

Investigations are also being carried on in cooperation with the State Board of Health of Montana to determine the practicability of the eradication of Rocky Mountain spotted fever, which investigations will be continued beyond this year.

Acute poliomyelitis has likewise engaged attention, studies of the disease having been made in Iowa, New York, and in the Hygienic Laboratory. Reports have been received from 31 States, the District of Columbia, and Hawaii, showing that during the year 1910 there were 5,093 cases and 825 deaths. Since this disease prevails mostly during the summer season it is probable that further opportunity will be given for studies, and that some administrative action looking to its prevention will have to be decided on by the several State authorities.

Lack of suitable cases of pellagra and other diseases for study emphasized the desirability of making provision whereby such cases could be admitted into the several marine hospitals. On request, the Sixty-second Congress at its last session accordingly granted authority to admit for purposes of scientific study not to exceed 10 cases of any infectious diseases into any one hospital at any one time. In view of this authority, systematic studies of pellagra have been begun at the marine hospital at Savannah, Ga., and similar studies of parasitic diseases have been undertaken at the marine hospital at Wilmington, N. C.

To-night we shall consider the subjects of poliomyelitis and anti-plague measures, and I hope that everybody here will be able to be present and participate in the discussions. You will observe that the program is rather long, but it is not intended to enter into the

discussion of the subjects except along certain lines. I hope the members of the conference will feel free to take active part in the discussions. We will now call for the report of the committee on regulations for the disposal of the dead. The matter of disposal of the dead came up at the last conference and members of the committee were appointed to consider questions in relation to the regulation of the transportation of dead bodies in interstate traffic, and particularly those bodies arriving at quarantine stations from abroad.

Report of Committee on Regulations for the Disposal of the Dead.

[Read by Dr. H. M. Bracken, Minnesota.]

During discussions of the question of the disposal and transportation of the dead, at the last annual conference, it was apparent that there was some lack of uniformity regarding the requirements with respect to this matter. An analysis of the laws and regulations presented at that time showed that in four States the provisions regulating the transportation of dead bodies were actually contained in laws, and that in the remaining States, Territories, and the District of Columbia the subject is covered by rules issued by the State boards of health and State boards of embalming, or both in cooperation.

As stated by the Surgeon General, the chief reason for presenting the question of the transportation of the dead for consideration at the last annual conferences was, however, to facilitate the transportation of bodies of persons who had died abroad, through quarantine to their destination in the United States. Some of the difficulties heretofore encountered in authorizing the landing and speedy transportation through several States was pointed out by one of us, difficulties which are not only annoying from an administrative standpoint, but working hardship to the family or friends of deceased persons, and which should be overcome by some simplification of procedure.

The question of the requirements for the preparation of dead bodies was also a subject of discussion, which brought out the fact that there are several differences in this matter in the several jurisdictions, due principally to the interpretation of the term "approved disinfectant," used in the amended regulations adopted by the Conference of State and Provincial Health Officers of North America in 1897 and amended in 1903. The extensive studies of chemical fluids used in the disinfection and embalming of bodies by the several boards, particularly the State Board of Health of Minnesota, and the investigations conducted during the past two years in the Hygienic Laboratory indicate that uniformity regarding the composition of these fluids is now entirely practicable, and might be made the subject of definite recommendations.

In view of the foregoing your committee believes that the following points are of primary importance from the standpoint of this report:

(1) The advisability of the adoption of a regulation making proper provision for the preparation of bodies and their transportation without interruption to their destination after inspection and the giving of pratique at the maritime quarantine stations.

(2) The determination of the essential ingredients that shall be required to be contained in an approved disinfectant and the method of use.

(3 The advisability of so amending existing regulations as to bring about uniformity which will permit of the shipment of dead bodies without interruption on the certificate of State health authorities.

TRANSPORTATION OF BODIES FROM ABROAD TO POINTS IN THE UNITED STATES.

Paragraph 86 of the United States Quarantine Regulations revised October, 1910, requires that the body of any person dead of quarantinable disease other than yellow fever shall not be allowed to pass through quarantine until one year has elapsed since death, and such bodies must be transported in hermetically sealed coffins, the outsides of which have been carefully disinfected. The diseases contemplated in this paragraph are plague, cholera, smallpox, typhus fever, and leprosy. In the transshipment of bodies dead of other contagious and infectious diseases, it has been the invariable rule of the Public Health and Marine-Hospital Service to require the carrying out of the provisions of the regulations adopted by the Conference of State and Provincial Health Officers of North America, and the importation of bodies under other conditions is not allowed. Notwithstanding this fact, the Assistant Surgeon General in charge of maritime quarantine states that it has been the invariable rule, in order to avoid possible delay in transportation and embarrassment and additional expense to friends of deceased persons, to communicate with the health authorities in every State through which the body would pass, so as to insure its speedy arrival at destination. The difficulties represented by one item alone, the amount of correspondence, is just cause for action that will bring about cooperation in this matter.

Your committee recommends, therefore, that when a body shall have arrived at a maritime quarantine station and found by the quarantine officer to have been prepared in accordance with existing rules for the preparation of dead bodies, that its transportation to destination be permitted in the several jurisdictions through which it must pass, on the certificate of the said quarantine officer, based on documentary evidence of a consular officer and inspection, that the body is properly prepared and will not endanger the public health. This provision would properly be embodied in a rule or regulation to be adopted by the several States and Territories, and in addition issued as an amendment to the United States Quarantine Regulations.

REQUIREMENTS REGARDING THE PREPARATION OF DEAD BODIES.

The recent investigations of the best methods for the preparation of dead bodies have developed results, which, in the opinion of the committee, might be made the basis for a regulation that would bring about uniformity of requirement with respect to this matter. It is observed that the regulations adopted by most of the States and Territories require the embalming of bodies dead of contagious and infectious diseases, and of bodies that can not reach their destination within 30 hours. These regulations, however, are not specific as to the methods of preparation, nor the essential ingredients of the fluids used for embalming purposes. The studies made by the State Board of Health of Minnesota have definitely determined that a fluid containing 5 per cent of formaldehyde is the most satisfactory from a public-health standpoint. The character of additional ingredients to this fluid, added for cosmetic purposes, makes no difference so long as they do not interfere with the effectiveness of the formaldehyde solution. The investigations conducted in the Hygienic Laboratory have given similar results, and in a report on this subject the director stated that "it would seem that an approved disinfecting fluid for use in the transportation of the dead should contain as its essential agent at least 5 per cent of formaldehyde gas, and for legal and medical reasons should contain no arsenic, zinc, mercury, copper, lead, silver, antimony, chloral, or any compound of them or any poisonous alkaloid." The extensive experiments made by the Assistant Director of the Hygienic Laboratory and reported at the last annual meeting

of the National Funeral Directors' Association indicate that an embalming fluid must contain at least 12½ per cent of 40 per cent formaldehyde solution and that the amount of fluid injected must be 15 per cent of the body weight. These investigations also indicate that a definite method of injection should be practiced, and that by so doing the body can be thoroughly disinfected and preserved almost indefinitely. The technique of injection is determined by a number of actual determinations as follows:

	Per cent body weight.
Inject each femoral artery toward toes with	2
Inject each brachial artery toward fingers with	1
Inject one carotid artery toward head with	2
Inject same carotid artery toward heart with	7
Total amount of fluid	15

With the method of injection outlined it is not necessary to withdraw blood from the veins, or to inject fluid into the abdominal or thoracic cavities, and should the face become distended with the fluid it is only necessary to dispel it with massage. The additional measures that have suggested themselves, and have been found in the above experiments to be necessary, are practically identical with existing requirements, as follows:

The plugging of the orifices with cotton saturated with the embalming fluid; the washing of the entire body, including exposed surfaces with the embalming fluid; the wrapping of the entire body in cotton saturated with embalming fluid, and holding it in place by the necessary bandages and a sheet securely fastened; the treatment of autopsied cases in the same way, with the addition of a liberal amount of cotton soaked in the embalming fluid, and placed in the cavities of the abdomen, thorax, and skull.

From the results of experiments made it is evident that a body dead of any communicable disease can by the above means be so sterilized and preserved as to insure its keeping indefinitely, and bodies so sterilized have been actually kept in an incubator at blood temperature for 60 days, with no evidence of the original infection or change apparent to an experienced undertaker. It is evident from this that such a body could not continue to be infections.

It appears to your committee from the work already done on this subject that a regulation might be adoped embodying specific requirements as to disinfection of bodies which would render them entirely harmless from the standpoint of the public health, and not interfere with the cosmetic effect aimed at by undertakers.

MODIFICATION OF METHODS OF HANDLING DEAD BODIES IN THE INTEREST OF UNIFORMITY.

In view of the foregoing the question arises whether some modification of existing practices can not be made in the interest of uniformity. This is a question, however, that must be carefully considered not only by the health authorities themselves, but in conjunction with the funeral directors and railway authorities. The shipment of a dead body should be facilitated by every means possible consistent with the safety of the public health, and there is nothing that will contribute to this end more than a clear understanding of requirements and cooperation of the State health authorities in their enforcement. That the danger of the transmission of contagious and infectious diseases depends in large measure on live persons infected with those diseases is apparent, and in comparison dead bodies are of minor importance. Besides, there is assurance

that such bodies can be so disinfected as to render them safe, and so prepared for shipment as to avoid their becoming a nuisance.

Your committee suggests, therefore, that this phase of the subject be further considered with a view, if practicable, to simplifying the requirements and rendering them the same for bodies dead of all contagious diseases and all bodies to be transported which can not reach their destination within a certain specified time. By such means it might be practicable to formulate regulations which would be acceptable to those States and Territories which have adopted the transportation rules amended in 1903; those still adhering to the original rules adopted in 1897; and those that remain outside of either group and have special rules of their own. In the event, furthermore, of the formulation of such uniform rules, they could serve as the basis of regulations contemplated in section 3 of the Federal quarantine act of February 15, 1893

H. M. BRACKEN.
W. R. BATT.
J. Y. PORTER.
GUILFORD H. SUMNER.
J. H. TOWNSEND.
L. E. COFER.

Dr. Swarts moved that the report be received and placed on file. Motion seconded by Dr. Parkinson.

Dr. Fulton moved that a committee be appointed to consider whether it should be the recommendation of the conference to take definite action upon the regulation of transportation of dead bodies crossing our boundaries.

Dr. SWARTS. Would it not be well for us to appoint a committee to formulate suggestions to the conference in Los Angeles?

Dr. PARKINSON. Could not the present committee act in this way?

Dr. KERR. We could adopt the report and invite the attention of the Conference of State and Provincial Health Authorities to it, and any amendments that might seem necessary could be incorporated later. If the committee's report was adopted by this conference, the chairman, Dr. Bracken, could bring it to the attention of the above-mentioned conference at Los Angeles. As far as taking final action on the methods of embalming bodies and the revision of existing regulations, these would necessarily need to be considered later, as it is not the object to take full action upon this matter until after it has been considered by the Conference of State and Provincial Health Authorities. I think a good plan would be to adopt this report now, so that the committee could be continued and the issue of regulations considered by the Surgeon General.

Dr. SWARTS. I withdraw my motion which is before the house as I do not think we are prepared to adopt this report, not enough action having been taken in regard to methods of embalming.

Dr. HEG. We get many bodies from South America and Asiatic ports in which the question of embalming is rather a dubious one, and I think that the regulations of the Treasury Department should

be specific along those lines. We get many bodies from Alaska, where there are not many undertakers, and these bodies come with a certificate from a doctor to the effect that they have died, and this is all the information that can be gotten from those certificates. There was so much of this that we now require all bodies that have not been shipped under the certificate of an embalmer licensed by our board, of whom a few live in Alaska, shall be turned over to a licensed embalmer before we will transport them. However, we have been accepting bodies from the Army surgeons and from the surgeons of the Public Health and Marine-Hospital Service.

Dr. Swarts. I understand from this report that a body should be permitted to pass on the certificate of a quarantine officer, based on documentary evidence from abroad. I would like to ask what documentary evidence can be obtained from abroad and whether a declaration upon paper is sufficient to render the inspection of a body unnecessary.

Dr. Kerr. No body is allowed to be shipped from a foreign port unless those interested receive a certificate from the American consul to the effect that disinfection has been essentially what is required in the United States. When we know what regulations are required in different States we can incorporate them in our regulations. When bodies regarding which there is doubt arrive at a maritime quarantine station autopsies are done, the object being not to allow ashore any bodies that would in any way be a menace to the public health. This matter has been brought before the conference simply for the purpose of facilitating the shipment of bodies. Under the present system friends and relatives are given much trouble, and it often causes embarrassment to the Government when the body of a foreign officer is shipped from a foreign country to or through the United States. If this conference could agree upon the advisability of uniform requirements that would be complied with by health authorities, and if the statements of the quarantine officers as to the safety of bodies would be accepted by them, that would meet the situation.

Dr. Tuttle. I think it is absolutely proper that a body should be shipped on a quarantine officer's certificate. I got a letter from a railroad in Alaska asking for a permit as they wanted to ship a body, and all the certificate stated that came with the body was that the man had died. It was perfectly evident that he had died—of that there was no question—but it did not state of what he had died. All we can now do is to watch for the dangerous ones and, if possible, catch them.

Dr. Godfrey. Last year at the Conference of State and Provincial Boards of Health the shipping of dead bodies was under discussion, and the question arose as to whether or not such bodies are at all dangerous to public health. A committee had been appointed to

report on the revision of the regulations, but had not considered this phase of the subject; this committee was continued and requested to obtain whatever information it could regarding this question and report to the meeting this year. It seems to me that the subject now under discussion is dependent upon that information in a large measure, and that perhaps we had better hold it over until we hear from that committee.

Dr. BRACKEN. Mr. Chairman, I suggest that yourself, Dr. Heg, and a third man act as a committee to formulate regulations to submit to the Conference of State and Provincial Health Authorities. My object is to bring together on this committee men who know of these things. This committee could formulate regulations to be passed on at the conference at Los Angeles.

Dr. SWARTS. If a committee is appointed why can you not give it the authority to confirm this action?

Dr. KERR. If there is no objection I might designate a committee to report later in the day upon the action that should be taken; their recommendations could be submitted to the conference later.

Dr. SWARTS. The consensus of opinion is that it will not be possible to make a report until action has been taken by the boards of health.

Dr. KERR. This conference should certainly be able to decide whether it is feasible to place in the hands of quarantine officers the authority to issue certificates for the transmission of bodies into other States, which certificates would be honored by local authorities, and this is the point in which we are particularly interested. Every State should have a uniform blank, which the Federal Government could also use and furnish American consuls. If suitable we could use the blank adopted by the conference in Los Angeles. This conference should take action so that the other conference in making its regulations will understand that it is our desire to have a satisfactory and uniform method of disposing of these bodies.

Dr. PARKINSON. I move that a committee of three be appointed by the Chair to report at a later session.

Motion seconded by Dr. T. D. Tuttle. Carried.

Dr. Kerr appointed the following to serve on this committee: Dr. E. E. Heg, Dr. C. O. Probst, and Dr. H. M. Bracken.

REPORT OF COMMITTEE ON MORBIDITY REPORTS.

The report of the committee appointed at the last conference to consider methods for securing improved morbidity statistics was then called for and presented by Dr. M. W. Richardson. The membership of the committee was as follows: Drs. Richardson, S. J. Crumbine, W. F. Snow, E. G. Williams, F. W. Shumway, and Asst. Surg. Gen. J. W. Trask.

The report is as follows:

Disease is no respecter of county or State boundaries, and for much the same reason that it is desirable that all counties within a State should report to the State authorities information in regard to the existence of certain diseases it is also desirable that the States report to some common authority in regard to the existence of certain diseases within the States, and that this data be made currently available for the information and protection of other States and for the assistance it will give in the study and solution of many epidemiological questions otherwise difficult or impossible of solution.

It is believed that the public interests would be conserved by adopting, in so far as possible, certain uniform practices in regard to the reporting of sickness, and that the conference could with advantage agree upon and recommend a plan which could be accepted as a standard of minimum requirements to be adopted in the various States, as opportunity afforded, by new enactment of law, the amendment of existing law, or by regulation. This plan might include the following:

(1) A list of diseases which present knowledge indicates should be reported in the interests of the community.

(2) The minimum information to be given for each case reported.

(3) The time and frequency for the reporting of cases:

(*a*) By the physician or householder to the local or State authorities.

(*b*) By the local authorities to the State authorities.

(4) (*a*) The diseases which the State authorities should report to the central authority.

(*b*) The information which should be included in the report.

(*c*) The frequency of these reports.

(*d*) The manner and frequency of publication of this information by the central authority.

(*e*) Whether the State authorities should make these reports to the central authority on their own responsibility, furnishing the necessary clerical work, or the central authority (the Federal Government) should pay for the labor necessary.

These points might be treated somewhat as follows:

I.

The list of diseases might include cerebro-spinal meningitis, cholera, diphtheria, dysentery, leprosy, malaria, measles, ophthalmia neonatorum, pellagra, plague, poliomyelitis, Rocky Mountain spotted fever, scarlet fever, smallpox, tuberculosis, typhoid fever, typhus fever, and yellow fever.

II.

The minimum information to be reported for each case should be made to include: Name of disease, name, age, sex, color, occupation, and residence of the patient, and in the case of smallpox, the vaccination history, and in tuberculosis the type (pulmonary, laryngeal, glandular, etc.).

III.

The time and frequency for the reporting of cases:

(*a*) By the physician or householder to the local authorities: Immediately (daily).

(*b*) By the local to the State authorities: Immediately, by telegraph, cholera, plague, typhus fever, and yellow fever. Daily, by mail, the other diseases.

IV.

(*a*) The diseases to be reported by the State authorities to the Public Health and Marine-Hospital Service. Cerebro-spinal meningitis, leprosy, plague, poliomyelitis, typhus fever, yellow fever, scarlet fever, tuberculosis, cholera, malaria, pellagra, Rocky Mountain spotted fever, smallpox, diptheria, measles, and typhoid fever.

(*b*) Information to be included in report made by States: The number of cases of each disease by counties and by cities having over 8,000 population. (For the securing of epidemiological data it might be of marked advantage to report the age, sex, color, and occupation of each patient.) In reporting smallpox the vaccination history of the case should be given; in tuberculosis, the type.

(*c*) Frequency of reports: Immediately, by telegraph, cholera, plague, typhus fever, and yellow fever. Monthly, other diseases.

(*d*) Manner and frequency of publication: The first case of the disease reported by telegraph might be telegraphed immediately to each State authority and published weekly in the Public Health Reports. The diseases reported monthly should be published monthly and annual summaries made.

(*e*) Responsibility for reports: The value of the reports to the States might warrant their assuming all responsibility for the forwarding of the reports to the bureau at Washington, which would really act merely as a common agent for the States, or a clearing house for epidemiological information. On the other hand the bureau might, with certain advantages, employ an agent to forward these reports. There would then be less embarrassment in some cases in securing the forwarding of the reports. The latter is believed to be preferable.

Dr. Kerr. What shall we do with this report? This subject is important enough to keep us occupied during the entire day. Dr. Trask thought it would be well to decide upon the number of diseases to be reported and the manner of reporting them. The question now is, therefore, whether it would be advisable at this conference to recommend definite action, and whether the Federal Government should pay for the clerical work to get up these reports. It may not be practicable to decide upon the number of diseases to be reported on; but it might be well to handle this subject as we have the previous one, and request that the three members of the committee who are present recommend tentatively to the conference those diseases which should be notified. Pennsylvania requires reporting of 31 diseases, so it would be manifestly unnecessary to ask Pennsylvania to add to her list; other States require only two or three. If we could decide upon a certain minimum number of diseases, might it not be possible during the coming year to get more complete reports from certain States?

Dr. Bracken moved that the report of the committee be received. Motion seconded by Dr. Parkinson. Carried.

Dr. Fulton. When I was doing State work I realized the difficulty of getting prompt and reliable morbidity reports from the local health officers. There was, however, very little lack of promptness in reporting smallpox. We in the State board of health were

generally delinquent about accounting to the United States Public Health and Marine-Hospital Service for our smallpox. As an executive officer, I was sensible of this delinquency, and regretted it. The negligence was not willful. It was practically unavoidable. We needed a regular employee specially and rather exclusively charged with the epidemic memoranda. Without such a person, we were wholly occupied with field work and with the transmission of information within the State itself. With the best intentions a regular correspondence with the United States Public Health Service could not be undertaken. There was rarely any smallpox to report, but we were never free from outbreaks of the common infections. The United States Public Health and Marine-Hospital Service does not publish weekly reports of measles, diphtheria, scarlet fever, and typhoid. If we had felt a necessity for transmitting each month or each week an account of the infections actually present, we might have succeeded in making that task a fixture for a clerk, and so habitually corresponded with the United States Public Health Service. But the occasions when we had smallpox were very few and transient, so that no one habitually thought of sending information to the Public Health Bureau in Washington.

I believe that the committee on morbidity reports should be continued, and I suggest that the common infections ought to be accounted for regularly, both because that information is valuable on its own account, and because their notification to the bureau will establish regularity in accounting for the unusual infections. In any event, the States will come into line one at a time and at considerable intervals.

Dr. Crumbine. After a few preliminary remarks I desire to make a motion. I think that this conference should take definite action on this report if they expect to bring about a better condition of affairs in this country. We should be able to tell just exactly what is going on in disease conditions in the States. Two weeks ago there appeared in the Kansas City Star an editorial upon the last issue of the Public Health Reports, giving a record of the smallpox cases for 1909, and the Star brought attention to the fact that Kansas had one-eleventh of the total number of smallpox cases in the United States and remarked "what was the matter with Dr. Crumbine and the State board of health," and I assure you that there was something doing in the newspapers all over the State, as the editorial was extensively copied. I called a reporter of the Star and showed him the Public Health Reports and convinced him that there were a good many more cases in Missouri than in Kansas because of their larger population, but their reports are not as complete as those of Kansas, one city only reporting 211 cases against our 2,000 cases for the entire State. These reports unless uniform

are not satisfactory and may be very misleading, and I believe that when these reports are made there should be a definite statement made by the Public Health Reports stating why certain States apparently have greater numbers of smallpox cases than other States.

I move that the Chair appoint a committee to bring in a resolution based on the report read by Dr. Richardson, taking definite action with the object of stimulating health officers, Federal, State, and local boards, to obtain and publish more accurate reports on communicable diseases, particularly smallpox.

Motion seconded by Dr. Parkinson. Carried.

The Chair appointed the following to serve on the committee; Dr. M. W. Richardson, Dr. S. J. Crumbine, Dr. William F. Snow.

Dr. KERR. It will be gratifying to the Surgeon General and to Dr. Trask to have a resolution of this character. We need more complete reports, and it is impossible for the Government to secure them without the aid of the States and local communities. If there is anything additional we can do we want to do it, and if we have the advice of this conference that some additional law or appropriations are necessary, it will be easier to obtain it.

Dr. SWARTS. I think we ought to make definite what diseases shall be reported and the minimum amount of information to be given.

ADMINISTRATIVE MEASURES NECESSARY DURING OUTBREAKS OF ACUTE ANTERIOR POLIOMYELITIS.

Dr. KERR. In outbreaks of poliomyelitis administrative measures are necessary, and the object of bringing this subject before the conference at this time is to take certain action with the view of getting uniform reports from different parts of the country. Poliomyelitis has been studied in Iowa, New York, and Virginia by officers of the service. Compilations of the data collected in these States have been made and published and are of considerable value, but a disease of the character of poliomyelitis must be studied in a broad way with a view of determining how it is transmitted, and as a result of Dr. Frost's work he feels that if there could be brought about the adoption of a uniform blank to be used by all the States it would be a very desirable thing. Dr. Frost has prepared a blank, based on the blank forms used in other States and upon his experience in collecting such data. I have the form here, and, if it is the sense of the conference, we would like to have action taken in this matter in order that the Surgeon General can advise a uniform blank to be used by the different States. Another subject in connection with poliomyelitis is the period of quarantine, and while the Public Health and Marine-Hospital Service has had no occasion to segregate these cases, still we are asked what period of quarantine shall be ob-

served. A committee of the American Pediatric Society has recommended four weeks. Some of the States require from three to four weeks, some 14 days, and others various periods. I would be glad if the conference could take action on the adoption of a blank form and on the period of segregation that should be observed. Action on the latter question would necessarily be tentative and might be changed in the Conference of State and Provincial Authorities. We want some definite basis as to the length of quarantine that should be observed in view of a probable recurrence of the disease. A number of the members have seen the blank form prepared by Dr. Frost, but perhaps it might be a good plan to read it so that if there are any other points that should be added or any questions in it that the conference thinks hardly worth while to ask physicians to report upon, the blank form can be amended. We will probably have occasion to use this blank form during the summer, and so would like to have the State health authorities decide upon a blank that they, too, would use.

Dr. Crumbine. Would it not be well to have this blank used in duplicate so that one could be kept and one sent to the department?

Dr. Kerr. I rather think that would be a good plan. I do not think that it would take more than eight or ten thousand for the entire country.

Dr. Swarts. I move that the Public Health and Marine-Hospital Service be recommended by this conference to furnish blanks for the collection of data on poliomyelitis.

Motion seconded by Dr. W. F. Snow. Carried.

Dr. Parkinson moved that a committee of three be appointed by the Chair to determine upon the blank form to be adopted, said committee to report at the evening session, and that copies of the form suggested be put in the hands of all members of the conference before the evening session.

Motion seconded by Dr. M. W. Richardson. Carried.

The Chair appointed the following committee: Dr. M. W. Richardson, Dr. E. E. Heg, and Dr. G. T. Swarts.

THE ADVISABILITY OF CALLING A SPECIAL CONFERENCE ON RAILWAY SANITATION.

Dr. Kerr. We have time to take up another subject before adjournment for the trip to the quarantine station on Angel Island. This would be the advisability of calling a special conference on railway sanitation. This subject has been discussed for years and it comes up practically every year, although we must recognize that sanitary conditions on railways, so far as passengers are concerned, are just about as good as the people demand. The railroads have really done more than the average traveler expects. There are certain questions,

however, that should be discussed and taken up probably in an informal way with the representatives of the railroads, and it has been suggested by one or two health officers that it might be advisable to have a joint conference of State health officers and representatives of the railroads. It has been suggested by a certain health officer in the Mississippi Valley that such a conference be called. It appears to me that it would be a good plan to have such a conference, especially in view of the coming International Congress on Hygiene and Demography to be held in Washington. The time and place of this conference will have to be considered and any action to be taken might well be considered by a committee. The subject is only brought to the attention of the conference with the object of discussing it very briefly and, then, if advisable, to name a committee which would consider the advisability of calling the conference.

Dr. Probst. A few months ago I was requested to take up by correspondence the matter of calling a conference with the view of securing uniform regulations to govern the spitting on trains and one or two other points. I did this. About the time that we were proposing to have it we received a letter from Dr. Wertenbaker suggesting that not only the Central States but all the States be included in this conference, and so we decided not to hold the proposed conference in view of the fact that a larger conference might be called, as suggested by our chairman to-day. I believe that it would be advisable to have a special conference with the railway authorities in regard to railway sanitation.

Dr. Bracken. When Dr. Probst wrote me of the proposed conference I was much in favor of it, thinking it would be the means of getting things started in the right direction. I would indeed be glad to see a conference called for the purpose of discussing at length the subject of railway sanitation. A few years ago I tried to get in touch with railway organizations that would take up the question of transportation of the living, but I could not find any such organization that would take any interest in the matter. A railway surgeon read a paper on railway sanitation before the National Association of Railway Surgeons at its 1910 meeting, and among other things in this paper was the statement that railway surgeons were, as a rule, only interested in surgery. Several years ago I tried to get the officers of a certain railway interested in railway sanitation, but I ran against the chief surgeon of this company, who queered the whole thing. As a rule the railway surgeon does not take any interest in railway sanitation. An exception to this statement is to be found in the chief surgeon of the Rock Island system, Dr. S. C. Plummer. Last year a move was made by that road to try and learn something about the sanitary conditions of its stations and cleaning yards. Two men were appointed who went over the entire system, and their reports

are on file. I think the railway surgeons are to meet in October, and it is a question whether this conference should be held before or after their meeting. A few years ago in our own State I called the representatives of the various railways together for the purpose of discussing sanitary problems. As a result, the Minnesota State Board of Health passed certain regulations, which the railroads were ready to enforce. But the Minnesota State Legislature has never seen fit to give these regulations legal standing.

Dr. Regensburger. One of the first recommendations that our board made for the betterment of these conditions was that cuspidors be put upon the ferryboats; it took us probably two years before we succeeded in getting the railroad companies to put these cuspidors upon the boats, and in going across to-day you will find, if you take the trouble to notice, that there is but one cuspidor in each section. It is obvious that these are not of much account, as the Oakland boats carry from 20,000 to 30,000 people a day, and these people spit all over the place. The cuspidor is too small and there are not enough of them. Another thing we have recommended is the abolishing of drinking cups on the railroads, but you will find that the cups are there, and on the ferryboats, just the same. Of course, as you know, the railroad companies of California were in politics at one time, but now matters are changed and we may be able to accomplish something.

Dr. Parkinson. I have found that one of the objections raised by railroad representatives was that regulations of this kind might interfere with interstate traffic. Our board wanted notices prohibiting expectoration placed in the cars, but the objection was raised that this would interfere with interstate commerce and that the railroads could not do it. The best way to do things is to find out how to do them and how not to do them, and I think that this conference should take this matter up.

Dr. Tuttle. Every railroad going through Montana has signs prohibiting expectoration in the cars. It seemed to me that in order to better conditions it might be well to notify the members of the railroad commissions to attend a conference. A meeting was called, I prepared rules, the members went over them, found them impracticable in some points and on other points they went me one better and made the rules stronger. I found the heads of the railroads were willing to adopt these regulations. We had trouble in enforcing these laws on account of the porters, who found it too troublesome to sweep with sawdust. Just before I left Montana I had two porters reported for this; they lost their jobs and had to pay the fine, and this will be apt to make the others pay more attention to the rules.

Dr. Hyde. I am heartily in favor of this discussion on railroad sanitation, and believe that if we ask reasonable reforms of the railroad companies that they will be willing to carry them out for the benefit of the traveling public. Last October we adopted resolutions advising the abolishment of public drinking cups, and tried to have the same enacted into law, but the last legislature thought differently. However, the Pullman people and the railroad companies generally have abolished the public drinking cup on their cars. I feel sure that whatever we ask the railroad companies to do in reason will meet with their hearty accord.

Dr. White. I think this conference is overlooking the biggest problem, and that is the open toilet. We find the largest percentage of typhoid cases among section hands, and I think we should devise some way of doing away with the open toilet on all the trains, and I fully believe that this can be done.

Dr. Heg. I am very much in favor of a special conference to discuss nothing but railway sanitation, but the discussion should extend further than merely the sanitation of the coaches. The sanitation of the roadbeds should be considered, the drinking water, and the possible way in which disease is spread by the railroads.

Dr. Bracken moved that the Surgeon General be requested to call a special conference to discuss railroad sanitation.

Motion seconded by Dr. G. T. Swarts. Carried.

Dr. Crumbine. I think that the matter of the foods transported by the railroads should receive attention at such a conference. At this time of the year, especially in the Central States, the hottest place you can find is on the railway platform, and that is where the cream, milk, and other foods are kept awaiting transportation or removal, and if we could succeed in getting the railway commission to issue an order requiring all of these things to be properly cared for in the shade we would be doing something really valuable. I would suggest that this conference be called at the center of the United States, which is Kansas City.

Dr. Kerr. In a special conference on railway sanitation the first thing to do would be to get acquainted with the railroad officials and to see what is being done. The railroads are doing a good deal along certain lines. The Pennsylvania Railroad has done a great deal in caring for their employees. I called at the superintendent's office in Philadelphia and was surprised to learn of the care they had taken to install safety devices and rest stations for their employees. I believe that the Surgeon General would like to have the advice of a committee with respect to the time of meeting and the subjects that should be taken up. It seems to me that it would be a good plan to appoint a committee of four or five that would attend to the corre-

spondence and assume part of the responsibility of holding the conference.

Dr. Bracken. I think it would be a good plan to appoint such a committee. It would invite the various States to take part in asking for this conference. As I understand it, such a conference can not be called unless a request is made from five or more States.

Dr. Probst. I move that a committee be appointed by the Chair, to formulate a plan for a national conference on railway sanitation.

Motion seconded by Dr. H. M. Bracken. Carried.

The conference then took a recess to enable the delegates and guests to make a visit of inspection to the Angel Island Quarantine Station, the immigration hospital, and the Federal plague laboratory. These inspections occupied the entire afternoon.

EVENING SESSION.

The conference was called to order at 8.30 p. m. by Dr. J. W. Kerr, and the special committee appointed at the morning session to consider the report of committee on the disposal of the dead was called upon.

Dr. Bracken. Your committee has taken up the report and has the following resolutions to present: at the committee meeting this evening there were present Drs. Probst, Kerr, Heg, and Bracken.

Resolved, That quarantine officials be given the same recognition as State officials of health in passing upon the transportation permits for dead bodies sent into the United States from other countries, and that the restrictions as to the shipment of dead bodies from other countries be also applied to Alaska and other United States possessions.

Resolved, That the suggestions relative to the method of undertaking bodies and the amount and standard of the embalming fluid used be made the basis of further study and investigation.

Dr. Probst. I move that this report be adopted.

Motion seconded by Dr. Converse.

Dr. Probst. Although I was on that committee, I would like to ask Dr. Bracken if it would not be well to define "quarantine officials" more exactly.

Dr. Bracken. I meant it to apply to United States public health officials, but Dr. Kerr thought it ought to be extended, so we made it general that way on purpose.

Dr. Kerr. It can be limited to Federal quarantine officials.

Dr. Bracken. I amend the motion that the report shall read "United States quarantine officials."

Amendment accepted. Motion carried.

ANTIPLAGUE OPERATIONS ON THE PACIFIC COAST.

Dr. Kerr. There remains on the program to be discussed the subject of "Antiplague measures on the Pacific coast." This subject has been thus far deferred to afford the members of the conference an opportunity to visit the various stations of the service where a great deal of antiplague work has been carried on. Since the antiplague measures have been largely directed by Surg. Blue, I shall ask him to open the discussion.

A Résumé of Antiplague Operations in California, from September, 1907, to June, 1911.

[By Surg. Rupert Blue, Public Health and Marine-Hospital Service.]

The 1907 outbreak began in August and lasted until January, 1908. The epizootic among the rats, however, was not suppressed in San Francisco until the following October. From August 14 to January 30, there occurred in the city of San Francisco 159 cases, with 77 deaths. In Oakland, during the same period, there were 12 cases, with 7 deaths. In addition to the cases above mentioned, several were reported in the transbay towns, and in the summer and fall of 1908 2 cases were discovered in Contra Costa County at a point remote from any possible connection with San Francisco or Oakland. Human plague has been found in the past two years in Alameda, San Benito, and Santa Clara Counties. In each rural case there existed a sufficiently intimate association with ground squirrels to warrant the assumption that the squirrel was the source of infection.

In September, 1907, on the request of the mayor, the Public Health and Marine-Hospital Service assumed the direction of the antiplague operations in San Francisco, and after the disease had been eradicated in 1908, the Surgeon General authorized an investigation of the conditions in Contra Costa County. The work, however, was not abandoned in San Francisco. It has been continued on a somewhat smaller scale up to the present time.

The measures which proved of value in the San Francisco and Oakland campaign may be briefly summarized, as follows: Systematic extermination of rats by means of traps and poisons, supplemented by a simultaneous attack on their food supply and habitations; rat-proofing of buildings; isolation of infected persons and the disinfection of infected houses. It may be pertinent to state here that the proper collection and disposal of garbage and the insulation of human habitations against rats are prophylactic measures that should be generally adopted in this country.

A partial summary of operations for San Francisco from the beginning of the epidemic up to June, 1911, will give an idea of the magnitude of the campaign. At one time there were more than 1,200 employees on the payroll. These were employed in the spring and summer of 1908 in the wrecking of insanitary buildings, destroying rat-harboring places, trapping, and poisoning, and in the general work of "cleaning up." The force consisted of medical officers, inspectors, assistant inspectors, foremen, laborers, and adequate clerical help in the various headquarters and substations of the special plague service. Bacteriological laboratories were maintained in San Francisco and Oakland in which rats and pathological specimens were examined for evidence of plague infection. It may be of interest to note that diagnoses of plague were confirmed in every instance by all known methods, including animal inoculations

and cultural tests, and that Federal, State, and municipal experts were required to pass on each human case before an official report was rendered.

The following statement shows some of the more important operations of the special plague service:

Buildings and premises inspected (including reinspections)	1,051,368
Buildings demolished	3,179
Buildings disinfected	14,126
Buildings made rat proof (not including stables)	13,778
Stables made rat proof (concreted)	3,438
Cellars made rat proof	12,279
Yards made rat proof	10,699
Chicken yards concreted	1,591
Square feet of concrete laid	18,593,637
Sick inspected	500
Plague cases	160
Dead inspected	5,711
Necropsies made	300
Plague cases found, at necropsy	9
Poisons placed	13,237,964
Rats collected	692,533
Garbage cans installed	61,858
The work of the plague laboratories:	
Rats examined	471,469
Found infected	436
Squirrels examined	243,048
Found infected	447
Other rodents examined	4,710
Found infected (wood rat)	1
Largest number of rodents examined in one day (May 16, 1911)	1,339

In addition, a great deal of valuable experimental work has been conducted by Passed Asst. Surg. G. W. McCoy, the bacteriologist in charge, which tends to clear up the remaining problems in relation to the transmission of plague.

Opportunity for the study of the diseases of rodents, bacterial and organic, and the best methods of exterminating the species, was afforded. The organic diseases were investigated for the first time and much interesting data collected. A new bacterial disease of squirrels (Citellus beecheyi) has been observed in which the lesions are almost indistinguishable from those of plague. Filariasis was also found to be present in the California ground squirrel.

The entomology of plague with special reference to the Siphonaptera of San Francisco and vicinity has received considerable attention in both laboratory and field. As a result, much valuable information on the bionomics of fleas and other ectoparasites of California rodents has been collected and published for the benefit of those engaged in similar work.

POST-EPIDEMIC MEASURES IN SAN FRANCISCO AND OAKLAND.

Of great importance in this connection is to know when to discontinue the eradicative work. It has been learned in the school of experience that the disappearance of human cases is not a safe guide, nor is the failure to find infected rats an infallible indication. In order to be on the safe side we adopted the rule, and laid down the principle, that certain procedures should be continued almost indefinitely after the last infected rat has been found. This work should include such measures as will reduce the rat population and

maintain it at the lowest possible mark throughout the year. The importance, therefore, of enforcing the special garbage regulations and the building ordinances as regards impervious material on ground surfaces and side-walls, can not be too strongly emphasized.

We have at present in San Francisco, Oakland, and Berkeley for this purpose a force of 50 men, consisting of 2 inspectors, 6 foremen, and 42 laborers. The San Francisco Board of Health furnishes 5 additional inspectors, who serve under the direction of this service. The satisfactory work of this small force is represented on the appended chart, which shows the rat catch by months in San Francisco from September, 1907, to June, 1911. The top of the curve, the maximum catch, was reached in the spring of 1908. Since that time, although more rat catchers were employed, and a larger number of traps set daily, the catch diminished until a fixed monthly rate was established. In view of this showing, it is not too much to claim that a rat population can be lowered and kept down by the application of appropriate means. It is to be noted on the chart that the highest average was 42,000 for the month of March, in 1908; the lowest was 4,300 for April, 1911. The number of traps in daily use at present is 7,500.

A systematic collection of rats from all sections of the city, in addition to diminishing their numbers, will enable us to detect an epizootic in time to adopt preventive measures before the occurrence of human cases. This is one of the chief aims of the present system.

PLAGUE IN RURAL CALIFORNIA.

In 1908, as above stated, two cases of human plague occurred in Contra Costa County. The investigations which followed failed to connect either with a previous case, but showed an intimate association with a rural rodent—the California ground squirrel. The finding of these cases was not an accident, but was the result of a carefully laid plan to ascertain whether or not infection had been conveyed to the rodents of the country districts. The condition had been suspected as early as 1903 and efforts were made then, and again in 1906, to collect sick and dead squirrels for examination, but without success.

In August, 1908, immediately following the above occurrence, an investigation was ordered, and a force of squirrel hunters was sent into the country. Between August 1 and October 15, 450 squirrels and 50 or more rats were collected in the northern part of the county. Four of the ground squirrels proved to be plague infected. In the following spring and summer (1909) an organized campaign on a larger scale was inaugurated for the purpose of learning to what extent the infection had spread. Scouting parties were sent into Alameda, San Joaquin, Stanislaus, and Merced Counties and specimens obtained for examination. In November, 1909, infection among the ground squirrels had been found so widespread in those counties that it became necessary to advance the line of investigation to the extreme limits of the State. Since that date the inquiry has covered 44 counties, parts of Arizona, Nevada, and Oregon, and the infected area accurately defined.

From the inception of the work up to June 1, 1911, there have been received at the laboratory in San Francisco 243,048 ground squirrels, 447 of which proved to be infected. Specimens of the other rodent families, such as gophers, rabbits, weasels, and brush rats, to the number of 4,710, were received during the same period. One of these, a brush rat (*neotoma*), showed the gross and microscopic lesions of plague. The infected animals were obtained in 10 counties, namely, Contra Costa, Alameda, San Joaquin, Stanislaus, Merced, San Benito, Santa Clara, Santa Cruz, Monterey, and San Luis Obispo. San Fran-

cisco and Los Angeles Counties are omitted because no infection has been found in them in the past two years.

It will be seen that the area affected lies in the central and coast regions of the State, extending from Suisun Bay on the north to San Luis Obispo County on the south. For a while it was thought that the San Joaquin River formed its eastern boundary, but in December last infected squirrels were shot near the town of Ripon, San Joaquin County, some 15 or 20 miles east of the river. It is to be observed that, in this instance, the river did not check the advance of the epizootic. Invasion of the northern countries, however, seems to have been prevented by the bay and marsh lands at the confluence of the Sacramento and San Joaquin Rivers.

There has been, apparently, a rapid distribution in the south through Santa Clara, Merced, San Benito, and Monterey Counties. This may be attributed, for the most part, to the unbroken continuity of rodent range found therein, and to the fact that squirrels are more numerous in this section than elsewhere in the State. These are the natural conditions favoring the spread of infection. The progress of the epizootic, I regret to state, has been aided by farmers in some cases. A rancher who lives in Santa Clara County, having heard of the fatal disease in Contra Costa, imported sick squirrels and liberated them on his lands. The effect was immediate and satisfactory, the squirrels being eradicated for miles around. This occurred some years ago, however, and the animals are now as numerous as ever.

From the foregoing statement, it will be seen that an extensive plague focus has been established in the central and coast counties of California, and that, in this instance, the ground squirrel (*Citellus beecheyi*) is the alternative host of the disease.

MEASURES FOR THE CONTROL OF RURAL PLAGUE.

The threatening possibilities of the situation have been fully appreciated, and comprehensive measures adopted to safeguard the public health. The Surgeon General has enlarged and extended the work as the investigations disclose new conditions that require either increased appropriations or the detail of additional officers.

The general plan of operations includes eradicative work in conjunction with the State and county officials, the maintenance of rodent free zones around the cities, and the continuance of the investigation to determine the location and extent of plague epizootics in California and near-by States. The joint Federal and county service is conducted with a view to enforcing the State law of March 13, 1909, entitled "An act for the extermination of rodents." Any violation of the provisions of the statute is deemed a misdemeanor, and is punishable by both criminal and civil action.

The boards of supervisors of 14 counties have agreed to enforce the law and have appointed inspectors to serve formal notice on all property owners and tenants of infested lands that a full compliance will be required. Federal inspectors have been detailed to supervise this work and to give expert advice on the best and most inexpensive methods of exterminating squirrels. Farmers, ranchers, and orchardists in these counties are complying in a most commendable manner, and great destruction is being accomplished.

One of the main objects of the campaign is to exclude infection from the centers of population. This is accomplished by preventing contact and the interchange of ectoparasites (fleas) between rural and urban rodents by (1) prohibiting the marketing of squirrels, and (2) the maintenance of rodent free zones around the cities. Broad areas, in which squirrels have been de-

stroyed, are at present maintained around the cities of San Francisco, Oakland, Almeda, Berkeley, and Point Richmond.

Another very important consideration is the prevention of a further spread among rural rodents. As a measure in the protection of the Eastern States and in the interests of the general commercial welfare, it is probably the most important feature of all. Among the cardinal indications suggested under this head are (1) destruction of known foci of infection, and (2) general rodent extermination. In the prosecution of this plan we have recently organized a number of field companies and have dispatched them to points of strategic importance in the infected area.

Each company consists of six men, and is supplied with a covered wagon, tents, kitchen utensils, weapons, and the necessary paraphernalia for a long stay in the field. It is our purpose to combat the natural conditions favoring the spread of infection. That is, to break the continuity of range by creating a free zone in front of the epizootic. There are two of these strategic points selected, namely: Ripon, in San Joaquin County, and San Miguel, in San Luis Obispo County. Other points will be sought and provided for in due time.

General rodent extermination has been taken up by the county officials, under the supervision of this service, and will be enforced as a continuous prophylactic measure for many years to come.

Plague Suppressive Measures—Systematic Rat Destruction in a Large Community.

[By G. M. Converse, Acting Assistant Surgeon, United States Public Health and Marine-Hospital Service.]

Antiplague work in a city may be divided into three periods:

First. Period of discovery of plague infection.

Second. Period of organization and active antiplague measures until disappearance of infection.

Third. Postepidemic period.

To these should be added, to be logical and in conformity with the principles or true preventive medicine, a preepidemic, or, more correctly speaking, a preepizootic period; that is to say, that in such communities as lie in the route of travel by land or sea with localities known to harbor plague infection the same measures should be adopted as are considered necessary during the postepidemic period. Such a timely intervention would save life, money, and avoid interference with the commerce of the community.

I shall confine my remarks to that phase of the work having to do with rat destruction—demurization, as it has been called, from Mus, a rat.

Here it may be well to remark that wherever wood construction is cheaper than brick or stone, as on the Pacific slope, there rats will find particularly favorable conditions for multiplying; if, in addition, the sanitary policing is lax, so that refuse of all kinds is easily accessible, then you have conditions that are perfect for harboring and feeding an innumerable number of these animals. These conditions already existed in San Francisco previous to the fire, and the combination of conditions produced by that catastrophe were such as to particularly favor the multiplying and harboring of rats throughout the city. A gentleman walking with a friend through a section of the burnt district shortly before the commencement of this campaign stated that in walking the distance of one block he counted over 100 rats scampering about.

Plague infection either carried over from the Chinatown epidemic of 1907 or introduced from some of the infected bay counties found a continuous chain of the rodents for spreading from one end of the city to the other.

In order to effectively destroy rats in a large commnnity it is necessary: (1) to trap or poison; (2) to shnt off the food supply; (3) to destroy and remove their harboring and breeding places.

(1) *Trapping and poisoning.*—There are employed in operations of trapping and poisoning 32 laborers. These are divided into four squads, each squad in charge of a foreman, and each having its own quarters in a different section of the city. These trappers attend to nearly 8,000 traps, exactly 7,613, of which 6,454 are so-called snap traps and 1,159 cage traps. As two of the laborers have no traps there is an average of 266 for each of the 30 trappers. The traps are scattered over the entire city, the exact distribution being regulated by the character of the premises in the varying sections. The city is divided into a number of exactly defined trapping sections, each trapper being allotted two of these sections; he attends the traps of one section on oue day and the traps of the other section the following day, etc. This trapping is controlled by the foreman, who has full charge of the men under him. He is responsible to the officer in charge for their discipline, for the condition of their traps, and for results obtained.

The result of these systematic and persistent trapping operations, taken in conjunction with other work to be described, is a steadily declining rat catch. This is best shown by a graphic tracing of the same, month by month, since the beginning of the work. Thus, during the month of March, 1908, with a large force of trappers, using about 6,000 traps, 43,000 rats were trapped; during the same month of March, 1911, 4,600 rats were trapped with 8,000 traps in the field. These are due mostly to other measures than trapping, for trapping alone would not have reduced these numbers to this extent. For instance, certain premises, which for a number of reasous it has not been possible to place in a rat-proof condition, show a constant and almost undiminishing rat catch month by month; such are several premises with wooden floors close to the ground and containing an abundance of foodstuffs, the owners of which procnred an injunction restraining the health authorities from compellig rat-proofing work; such, also, two large grain warehouses, which by the uuusual physical conditions of the land ou which they are built have made efficient rat proofing impracticable.

An important feature of trapping not to be overlooked is the trapping of vessels and of the water front; thus in a period of six months just elapsed the records show a catch of something like 6,000 rats from these sonrces alone.

The traps are baited with bacon, cheese, bread, or any other foodstuffs that the trapper finds acceptable to the rats. During one year, from April 1, 1910, to April 1, 1911, there were used 1,263 pounds of cheese, 3,565 ponnds of bacon, and 6,602 loaves of bread. This amount of bait furnished 1 ouuce of bacon and cheese per snap trap per month, 8 ounces of bread per cage trap per mouth. Nnmerous other systems of catching rats have been tried, such as barrels, etc., but they are not practicable for use on a large scale.

In addition to trapping, poisoning is essential particularly in certain localities. Various poisons have been used, but that which has given the most satisfactory and uniform result is a proprietary preparation containing phosphorus. It is spread on bread and the bread cut into cubes and distributed in this form. From 6,000 to 8,000 pieces of poisoned bread are spread daily, the poisoning being conducted under the immediate supervision of the foreman. At the present time this poison is distributed only in such portions of the city as will entail absolutely no risk to humau life; for example, the entire water front, butchertown, freight depots, etc. Although not many rats are recovered as a result of systematic poisoning, its good effect has been well proven. In the early part of the work thousands upon thousands of dead rats were seen floating out of

the sewers into the bay; during a considerable period of time the trappers in charge of the slaughterhouse section used to trap from 100 to 200 rats daily. Heavy and systematic and repeated poisoning has reduced this number until now only 5 or 10 rats are trapped there a day, inspection of the territory showing that this is not due to inefficiency on the part of the trapper, but to the absence of rats.

(2) *Shutting off the rats' food supply.*—This includes the providing of proper receptacles for food refuse throughout the city and constant inspection to see that these are renewed, that no refuse is thrown about, etc. Sixty-two thousand garbage cans have been procured through the efforts of the inspectors in addition to those already in use.

(3) *The destruction and removal of harboring and breeding places.*—During the earlier part of the campaign, when there was a sufficient number of officers and inspectors to make systematic inspection and investigation of all premises in the city, rat proofing could be accomplished in that way. As the exigencies of the work diminished and a consequent material reduction in the force was made (at the present time there are but two inspectors for the entire city), it became evident that some system by which rat-infested localities could be determined would have to be employed. This consists of a map on which the location of rats trapped is shown by means of colored pins; this map, taken in conjunction with the record books, makes it possible to see at a glance the localities in the city that are particularly infested. In this manner it was found that the section of the city inhabited by the Japanese was heavily infested, the trappers from this section bringing in from 60 to 75 rats each day. A systematic inspection of this restricted section showed the presence of wooden floors in stores and dwellings, wooden floors covering yards, the presence of large amounts of foodstuffs, and a congested population of Japanese. The owner of each parcel of this property was found, the necessity of removing all these wooden floors explained to him, and specific directions by letter were given him directing the nature of the concrete work to be done. The ultimate result was the concreting of almost the entire surface of the Japanese district and the reduction of the rat catch from 60 to 75 per day to 5 or 10 per day, scattered here and there throughout the district. Thus, also, the map showed a considerable rat catch in that portion of the city built up with steel, concrete, and brick buildings. On consulting the records it was found that in a period of five months 5,000 rats were trapped in 60 supposedly rat-proof buildings. Investigation showed the reasons for this infestation to lie in the fact that rats enter these buildings through openings left in the basements, walls, alongside of pipes, wires, etc. The owner of property must be found and notified; he is then furnished with specific instructions as to the necessary work to be done, said work to be reinspected after completion. To date 180 such buildings have been thus treated. Simple as this phase of the work appears, its real extent is shown by the fact that in one building, in order to do away with rat infestation, it was necessary to seal with concrete 690 openings around pipes, 137 other openings, to screen 57 ventilators on the roof and 40 ventilators in the basements, together with screening some 30 unused chimney flues. These figures happen to be available from the fact that the contractor doing the work had to account for the same.

The result of this portion of the work begins to be available after a sufficient period of time has elapsed since the completion of the work. Thus in 30 such buildings showing a rat catch of 1,650 rats for a period of three months prior to rat proofing, the same 30 buildings have furnished but 624 rats for the three months succeeding the completion of the work.

There are in the city of San Francisco 4,216 stables, and the number is being added to each week by permits granted by the board of supervisors; 3,337 of these stables have been rat proofed by means of concrete floors, etc., most of them during the actual epidemic work. A considerable number could not thus be treated at that time owing to a variety of circumstances, among them being short leases, lack of funds, etc., and these are being taken up as fast as practicable. Official notification of new permits granted for the erection of stables is furnished this office and inspections are made to see that they comply fully with the rat-proofing laws provided for the same. While the rebuilding of stables in such a manner as to make them rat proof has been the chief consideration, the question of the breeding of flies in the manure has not been lost sight of, and as much as possible the manure bins have been made fly proof as well as rat proof.

Dr. Snow. I have brought you some newspaper clippings which I think you will find of interest. I thought that Dr. Blue in his modesty would not say much about the success which he has had in getting the people to stand by him in the work that he has done. These clippings are the best proof of his tact and energy in conducting the campaign. I presume that you all remember the spring of 1903 when California was having a rather hard time from the citizen's point of view, and most of you met in Washington to decide what you would do to California if the citizens of the State did not wake up and realize the dangers of the plague to both themselves and the Government. At that time Dr. Foster and others were appointed a State board of health and given authority from the new governor to do whatever was necessary in ridding the State of plague. Dr. Foster went to Washington, stated the situation, and made certain promises. His report, which he presented to the board of health upon his return, is of considerable interest. In July, 1903, California agreed to cooperate in every way possible in this problem and I believe that the citizens of California have made good. From that time forward there have always been some who persist in saying that plague did not exist in California; that plague, like smallpox, is a disease of filth; and that in this advanced age of sanitation and with the climate of California this disease could never get a strong foothold, even if it did exist here. But such ideas are not representative of general public opinion.

When the later plague outbreak did start here the citizens felt most fortunate that the Federal service had men in Washington who knew in advance what the situation was. Especially did they appreciate having Dr. Blue returned to them for command of the local situation. Dr. Blue was fortunate in having Dr. McCoy and Dr. Rucker as assistants. Dr. McCoy has done and is still doing some remarkable scientific pioneer work on this problem. Dr. Rucker carried on the field work, of which you will see something to-morrow, and you can not realize before you see it what a difficult problem he had before him.

To keep the public interested in this work has been a problem. Just now we are trying to get the citizens in the rural districts to lend their assistance, and it takes a great deal of tact and personal effort to accomplish anything in this line. The State board can do little by itself because of the lack of funds. It seems to me that a problem like this one of plague is altogether too big for a State to handle and is necessarily a national problem in its importance. It becomes a question of just how it shall be handled, and it is a matter of cooperation of State and Nation. In this State it has seemed to work itself out very satisfactorily in a cooperative way. The city of San Francisco requested the Federal Government to send representatives here to assume the charge of this campaign. When it became a rural problem the State board of health made the request that it be put under the supervision of the Federal Government. The question of expense is one of importance that has not been mentioned. The United States Government is spending, and has been spending, between \$12,000 and \$15,000 a month in their part of the work. Just now we have the counties contributing something like \$2,000 per month—possibly more than that. The State has had rather a hard time, so far as the finances are concerned, on account of the changing of the system of collecting taxes, and there is but a small amount of money left in the contagious-disease fund for carrying on this work at the present time. The State board of health faces an uncomfortable problem if any unforeseen situation should develop requiring a sudden increase in the State expenditure, but I have no doubt that if such a thing should transpire that some way would develop for raising money.

Dr. Parkinson. It might be well to put on record at this time that when Dr. Kellogg first reported that he had demonstrated the existence of plague here, I published the case, and there was a storm of disapproval from the San Francisco newspapers. A fight was kept up in the campaign against plague, and no one who was not on the ground at the time would realize the bitterness of feeling on this question. The Medical Times published case after case, with all the facts pertaining to them, and the Sacramento Bee did the same thing. Those opposed to giving the facts to the public were a small coterie of men connected with transportation companies of the State and political appointees. The medical profession was loyal to the truth, and the San Francisco County Medical Society and the State Medical Society passed resolutions stating that plague existed in California, and calling upon the State board of health to do its duty and tell the truth. Precisely the same men who opposed publicity of the facts were the ones who opposed the resolutions in each society—I know, because I wrote the resolutions and put them

through. The Southern Pacific Co. kept men on the trains to interview men attending State meetings to urge them to suppress the fact that plague existed, saying we would be ruined if they were known, absolutely ignoring the fact that the Marine-Hospital Service was publishing this material and sending it all over the world. Nevertheless the San Francisco newspapers persisted in denying the existence of plague. This lasted until Gov. Pardee came into office, when he sent for me (I was on the Sacramento Bee) and he said that he wanted to know what it was that the paper wanted, and I told him all the paper wanted was that the truth be told. He said if we thought he would shoulder that responsibility for the administration we were mistaken, because he would not do it. Finally he asked that if we stopped what wonld we require, and I said we reqnired only that the truth of the situation be told. After that it came out in plain English, and we stopped pitching into the governor of the State. A representative of transportation then went to Washington to suppress this thing, and when he found that that was impossible he turned around and posed as the savior of California, and came back and made a report to that effect. The lying and vilification rested with a small coterie of men. In October, 1907, Dr. Blue said that he was refused admission to six houses in San Francisco, and then it seemed about time to do something. I asked the council of the State society to take charge of this thing. Dr. Evans was president of the society and I was chairman of the committee; a special meeting was called, and it was decided to commence a campaign of education. The committee spent a whole day and evening selecting the men who were to take charge of this work. What we wanted were men who were not afraid of the newspapers and who would stand up and tell the truth. Six hundred invitations were sent out for a meeting and there were 60 present. Two good men were present, and they promised the profession an audience if they had a meeting room, and two weeks later a most successful meeting was held in the Merchants' Exchange Building. After that I went home. Most of the trouble was solely due to a noisy coterie, but the great body of the people was honest and sincere, but they did not have the newspapers.

Dr. Heg. As representative of one other section of the United States that has been afflicted with plague I shall discuss the question. I wish to state first that I think that the invasion of plague which we had in Seattle was one of the best things that ever happened to the city of Seattle or the State of Washington—it brought our sanitary conditions to a much higher standard. In the city of Seattle in 1907 three cases of plague were discovered. There were four or five others that were suspicious of plague, but the diagnosis was never confirmed. Prior to that time the city was spending about $10,000

or $12,000 a year in the routine way, supporting a board of health, and it was doing nothing but reporting a few cases of diphtheria and smallpox and a birth and a death or two and some things like that. Immediately after the Public Health and Marine-Hospital Service took charge of things more was spent in one month than had been spent in a whole year. We are now spending from $150,000 to $200,000 a year and are doing excellent work and there is a prospect next year of spending probably double what was spent this year. The death rate has dropped, but that is not all. The death rate from typhoid fever and diarrheal diseases was cut more than half. When we found that there was plague in Seattle we took our lessons from San Francisco, and we did not hesitate to come out squarely with the first case. The newspapers stood with us. We did not have a ring of transportation officials that had control of everything in the State. We came out strongly and stated that we had plague and that we were spending money to suppress it. But to keep on getting the money for this purpose we find to be a rather hard job. We can get money for almost anything but we can not get much money for plague now, but, as Dr. Blue stated, antiplague measures must be kept up practically indefinitely. The last plague rat that we found was in April, 1910, and prior to that time 18 months elapsed, during which we had not found a plague rat, and then only 1 was found, although the district was carefully trapped and isolated. This shows that, although trapping is carried on systematically, you will run for a long period and then pick up a plague rat. I have studied the migration of rats in our State; in 1908 I had the State well canvassed for rats and I found, while one-third of the human population was west and the other two-thirds of the population was east of a range of mountains, that east of the mountains there were practically no rats, while they were abundant in all places west of the mountains. Later, on the east side, along the lines of railroads, in a few places, rats were to be found. Now rats are not found off the railroads on the east side of the mountains, but only along the lines of travel. They have traveled from one part of the State to the other and I think if they could travel 300 miles across our State that they certainly can travel a great deal farther. If a rat can travel from Seattle to Spokane, I do not see any reason why he can not travel from Seattle to St. Paul. How this infection of ground squirrels is going to affect our State I do not know. I hope you will keep them all here as we do not want them. From the very beginning to the present time the antiplague measures in Washington have been under the supervision of the Public Health and Marine-Hospital Service.

Dr. Probst. I move that this conference express its commendation of what has been done and is being done for the protection of the United States by the Federal, State, city, and county officials, and express full confidence in the measures now being taken here to protect against plague.

Motion seconded by Dr. Crumbine. Carried.

A REGISTRATION AREA FOR SICKNESS REPORTS SUGGESTED.

Dr. Richardson. The committee on reporting on morbidity statistics has not been able to get together and I would suggest that the matter be continued and a report be made at the next conference.

Dr. Kerr. I think it might be well to accept the suggestions of the committee and keep the question in our minds by correspondence and make it the subject of discussion at the next conference, as it is one of the most important subjects that can be taken up between the States and the service.

Dr. Snow. This question of making progress by the reporting of morbidity statistics is one of the most important subjects that has or can come before us at this stage of our development of public-health work. I feel that something more active should be done than just casual correspondence. The Federal service has done a tremendous amount of work getting together for comparative study the data from various States on their laws relating to morbidity statistics. I hope that something very active will come from the committee's suggestion that this matter be taken up by letter. I believe that a registration area should be established.

Dr. Crumbine. I move that it is the consensus of opinion of this conference that the Surgeon General be asked to constitute a registration area for morbidity statistics.

Motion seconded by Dr. W. F. Snow. Carried.

Dr. Kerr. It is the desire of the Surgeon General to get more complete statistics. The reason this subject was brought before the conference this year was to make a start and to get men engaged in the compilation of statistics, but it must be borne in mind that it is much more difficult to establish a registration area for notifiable diseases than for mortality statistics. I think that perhaps much time will be lost if this subject is considered only through correspondence. I am anxious that some action should be taken.

PROPOSED METHOD OF COLLECTING DATA REGARDING POLIOMYELITIS.

Dr. Kerr. We will now take up the subject of the adoption of a uniform blank for the collection of data regarding poliomyelitis. I will now call upon Dr. Richardson, chairman of the committee, to make his report.

Dr. RICHARDSON. The committee has gone over this blank, copies of which you have all seen, and in general it is an excellent one. There are three changes which the committee would like to have made in this blank, and if these changes are approved by the conference the committee will approve of the blank as submitted. The following are the three proposed changes:

(1) In case patient lives in the country, that the approximate distance of patient from the center of town be stated.

(2) That the occupations of the parents and other adults in the family be stated.

(3) The kind of treatment and its probable value be stated.

Dr. HEG. I move that this blank with the suggestions made by the committee be approved.

Motion seconded by Dr. Parkinson. Carried.

Dr. KERR. By correspondence we will apprise the other State boards of the action taken and get them to take up the matter. After I return to Washington I will take up the possibility of getting the blanks published, of which the following is a corrected copy:

Indicate by check whether { Paralyzed case——— or Abortive case——— }

Case report of acute anterior poliomyelitis.

Patient's name, ________________________________; age, ______; sex, ________
Nationality of father, ______________________; of mother, _________________
Occupation of father_______________________, of mother___________________
Residence (post office), ______________________; county, _________________
Did patient live in city? __________; village? __________; country? __________
If in country, state distance from center of nearest town or village__________
Status of family: Well-to-do? ________; moderate? ________; poor? ________
Sewage disposal: Flush closet? ________; cesspool? ________; privy? ________
General sanitary conditions: Excellent? ____; good? ___; fair? ___; bad? ___
Previous general health of patient: Excellent? ____; good? ____; poor? ____
Had patient suffered from any illness, indisposition, or accident within a month prior to this attack? __________; nature of illness or accident? _________
____
____

OTHER MEMBERS OF FAMILY (INCLUDING GUESTS, BOARDERS, AND SERVANTS).

Children: Males (age of each)____
Females (age of each)_____________________________________
Adults: Males, number _______________; females, number _______________
Were there any other cases of sickness in the family within one month before or after this attack? ________ Give name, age, sex, date, and nature of each case ____
____
____

SYMPTOMS OF ACUTE STAGE.

Fever: High? ________; moderate? ________; slight? ________; none? _______
Headache? _____; severe? _____; moderate? _____; slight? _____; none? _____
Constipation? ______ Diarrhea? _____ Vomiting? _____ Sore throat? _____
Pain? ______________________ Distribution? ______________________________
Tenderness? ______________________ Distribution? _________________________
Retraction of head? ________ Restlessness? ________ Drowsiness? ________
Date of onset of acute symptoms? ______________________________________
Date of onset of paralysis? ____
Distribution of paralysis at its worst _________________________________
____

What treatment was employed, and with what apparent results? ____________
(a) In acute stage ____
____
(b) Subsequent to acute stage ____
____

OUTCOME OF CASE TO DATE.

Recovery? (complete disappearance of paralysis) ________________________
Improvement? ________ Extent of paralysis remaining ____________________
____
Death? ______________________ Date? ____________________________________

CONTACT WITH PREVIOUS CASES.

Had patient been associated with any previous case? _________. If so, state whether paralyzed or abortive case? __________ Give name, address, and date
____

Had any member of the patient's family been associated with any previous case? ______ If so, state whether paralyzed or abortive _______________ Give name, address, and date ____
____

Did patient attend school? ______ Where? __________ Grade? __________
What were the weather conditions immediately preceding this attack—Hot? _______ Mild? _______ Cold? _______ Wet? _______ Dry? ________ Dusty? ______ Unusual in any respect? _________________________________
Have any infective diseases, respiratory or digestive troubles been unusually prevalent in the community? ______________________________________
What animals or fowls are kept on the premises? ________________________
Has there been any paralysis of animals in the vicinity? ________________
____
What preventive measures were carried out? ____________________________
REMARKS. Please state any other facts of interest concerning the case ______
____
Date of filling out report ________________ Signed __________________ M. D.

Dr. KERR. As I have not yet appointed the committee on railroad sanitation I now appoint the following: Drs. C. O. Probst, H. M. Bracken, J. A. Egan, T. D. Tuttle, and M. L. Price. The hour is growing late and we must not forget that after this meeting we have an engagement with Dr. Regensburger to visit the municipal clinic.

I desire to express the pleasure it has given me to meet the conference in San Francisco. On behalf of the service and the Surgeon General I desire to thank those who have been in attendance.

Dr. SWARTS. I move that a vote of thanks be extended to the hosts that have received the conference during this meeting and to express the appreciation for the kind hospitality extended to us by the State Board of Health of California.

Motion seconded by Dr. C. O. Probst. Carried.

Dr. KERR. Again I desire to express the appreciation of the Surgeon General and the service for the attendance of the members at this conference, which I now declare adjourned.

Conference adjourned.

APPENDIX.

State and Territorial Health Authorities in the United States.

[Corrected September 15, 1911.]

Alabama:

The State board of censors, acting as a State board of medical examiners and as a State committee of public health—

Dr. W. H. Sanders, chairman, Montgomery.
Dr. D. F. Talley, Birmingham.
Dr. L. W. Johnston, Tuskegee.
Dr. M. B. Cameron, Eutaw.
Dr. Glenn Andrews, Montgomery.
Dr. S. G. Gay, Selma.
Dr. I. L. Watkins, Montgomery.
Dr. S. W. Welch, Talladega.
Dr. T. L. Robertson, Birmingham.
Dr. V. P. Gaines, Mobile.

W. H. Sanders, M. D., State health officer, Montgomery.
P. B. Moss, M. D., State bacteriologist and pathologist, Montgomery.
G. W. Williamson, M. D., registrar of vital and mortuary statistics, Montgomery.

Alaska:

(Alaska has no District board of health.)

Arizona:

Territorial board of health—

Gov. Richard E. Sloan, president, Phoenix.
Attorney General J. B. Wright, Tucson.
Edward S. Godfrey, jr., M. D., secretary and superintendent of public health, Phoenix.

Arkansas:

State board of health—

J. P. Runyan, M. D., president, Little Rock.
J. P. Sheppard, M. D., secretary, Little Rock.
John R. Dibrell, M. D., Little Rock.
R. S. Hilton, M. D., El Dorado.
B. L. Harrison, M. D., Jonesboro.
E. H. Abingdon, M. D., Beebee.

California:

State board of health—

Martin Regensburger, M. D., president, San Francisco.
W. Le Moyne Wills, M. D., vice president, Los Angeles.
Wallace A. Briggs, M. D., Sacramento.
F. K. Ainsworth, M. D., San Francisco.
O. Stansbury, M. D., Chico.
Wm. F. Snow, M. D., secretary, Sacramento.
James H. Parkinson, M. D., Sacramento.

COLORADO:

State board of health—

Sherman Williams, M. D., president.
Jacob Campbell, M. D., Boulder, vice president.
Paull S. Hunter, M. D., Denver, secretary and executive officer.
Crum Epler, M. D., Pueblo, treasurer.
S. R. McKelevey, Denver, medical inspector.
B. F. Wooding, M. D., Denver, inspector lying-in hospitals.
James Rae Arneill, M. D., Denver.
Charles Morrison, M. D., Colorado City.
Arnold Stedman, M. D., Denver.

CONNECTICUT:

State board of health—

Edward K. Root, M. D., president, Hartford.
Joseph H. Townsend, M. D., secretary; office at Hartford.
T. H. McKenzie, C. E., Southington.
Lewis Sperry, Esq., Sonth Windsor.
Albert W. Phillips, M. D., Derby.
Arthur J. Wolff, M. D., Hartford.
Louis J. Pons, M. D., Roxbury.

DELAWARE:

State board of health—

William P. Orr, M. D., president, Lewes.
J. W. Clifton, M. D., Smyrna.
W. F. Haines, M. D., Seaford.
J. A. Draper, M. D., Wilmington.
E. R. Steele, M. D., Dover.
C. A. Ritchie, M. D., Middletown.
A. E. Frantz, M. D., secretary and executive officer, Wilmington.

DISTRICT OF COLUMBIA:

William C. Woodward, M. D., health officer, Washington.

FLORIDA:

State board of health—

E. M. Hendry, president, Tampa.
H. L. Simpson, M. D., Pensacola.
John G. Christopher, Jacksonville.
Joseph Y. Porter, M. D., State health officer and secretary State board of health, Jacksonville and Key West.

GEORGIA:

State board of health—

W. F. Westmoreland, M. D., president, Atlanta.
Charles Hicks, M. D., vice president, Mount Vernon.
H. F. Harris, M. D., secretary and director of laboratories, Atlanta.
W. W. Owens, M. D., Savannah.
A. P. Taylor, M. D., Thomasville.
M. S. Brown, M. D., Fort Valley.
James H. McDuffie, M. D., Columbus.
Howard J. Williams, M. D., Macon.
R. M. Harbin, M. D., Rome.
Samuel C. Benedict, M. D., Athens.
Giles Hathcock, M. D., Belton.
W. H. Doughty, M. D., Augnsta.

Hawaii:

Territorial board of health—

J. S. B. Pratt, M. D., president.
Alexander Lindsay, jr.
F. C. Smith.
A. R. Keller.
D. Kalauokalani, sr.
Jas. F. Morgan.
W. C. Hobdy, M. D.
K. B. Porter, secretary, Honolulu.

Idaho:

State board of health—

Geo. E. Hyde, M. D., president, Rexburg.
Ralph Falk, M. D., secretary, Boise.
W. R. Hamilton, M. D., Weiser.
Attorney General D. C. McDougal.
C. D. Mason, State chemist, Boise.
J. H. Wallis, dairy, food, and sanitary inspector, Boise.
A. E. Robinson, State engineer.
C. B. McGlumphy, bacteriologist.

Illinois:

State board of health—

George W. Webster, M. D., president, Chicago.
Charles J. Boswell, M. D., Mounds.
R. E. Niedringhaus, M. D., Granite City.
Walter R. Schussler, M. D., Orland.
P. H. Wessel, M. D., Moline.
Henry Richings, M. D., Rockford.
James A. Egan, M. D., secretary and executive officer, Springfield.

Indiana:

State board of health—

Fred. A. Tucker, M. D., president, Noblesville.
T. Henry Davis, M. D., vice president, Richmond.
James S. Boyers, M. D., Decatur.
John R. Hicks, M. D., Covington.
J. N. Hurty, M. D., Ph. D., secretary, Indianapolis.

Iowa:

State board of health—

Attorney General George Cosson, Des Moines.
J. I. Gibson, State veterinarian, Des Moines.
Lafayette Higgins, C. E., Des Moines.
A. C. Moerke, M. D., Burlington.
B. L. Eiker, M. D., president, Leon.
Albert de Bey, M. D., Orange City.
T. U. McManus, M. D., Waterloo.
E. E. Richardson, M. D., Webster City.
G. A. Smith, M. D., Clinton.
G. A. Huntoon, M. D., Des Moines.
Guilford H. Sumner, M. D., secretary, Des Moines.
Henry Albert, M. D., director bacteriological laboratory, Iowa City.
Prof. C. N. Kinney, chemist, Des Moines.

KANSAS:

State board of health—

B. J. Alexander, M. D., president, Hiawatha.
C. D. Welch, vice president, attorney, Coffeyville.
Clay E. Coburn, M. D., Kansas City.
C. H. Lerrigo, M. D., Topeka.
V. C. Eddy, M. D., Colby.
M. F. Jarrett, M. D., Fort Scott.
C. W. Reynolds, M. D., Holton.
O. D. Walker, M. D., Salina.
H. L. Aldrich, M. D., Caney.
W. O. Thompson, M. D., Dodge City.
S. J. Crumbine, M. D., secretary, Topeka.

Members of the advisory board.

F. O. Marvin, A. M., Mem. Am. Soc. C. E., sanitary adviser, Lawrence.
William C. Hoad, B. S., Asso. Mem. Am. Soc. C. E., sanitary and civil engineer, Lawrence.
E. H. S. Bailey, Ph. D., chemist, State University, Lawrence, food analyst for board.
J. T. Willard, M. S., Agricultural College, Manhattan, food analyst for the board.
L. E. Sayre, Ph. M., State University, Lawrence, director of drug analysis.
R. S. Magee, M. D., pathologist, Topeka.
Sara E. Greenfield, M. D., bacteriologist, Topeka.
W. J. V. Deacon, registrar, Topeka.

KENTUCKY:

State board of health—

Joseph M. Mathews, M. D., president, Louisville.
H. S. Keller, M. D., Frankfort.
John G. South, M. D., Frankfort.
William A. Quinn, M. D., Henderson.
C. Z. Aud, M. D., Cecilian.
O. C. Robertson, M. D., Cynthiana.
J. C. Mitchell, M. D., Louisville.
J. N. McCormack, M. D., secretary, Bowling Green.

LOUISIANA:

State board of health—

Oscar Dowling, M. D., president, Caddo Parish.
Beverly W. Smith, M. D., vice president, St. Mary Parish.
T. T. Tarlton, M. D., St. Landry Parish.
Herman Oechsner, M. D., Orleans Parish.
G. W. Gaines, M. D., Madison Parish.
B. A. Ledbetter, M. D., Orleans Parish.
Thomas A. Roy, M. D., Avoyelles Parish.
E. S. Kelly, M. D., secretary, Orleans Parish.
Sidney D. Porter, M. D., medical inspector, Avoyelles Parish.
George B. Taylor, analyst, Orleans Parish.
P. E. Archinard, M. D., bacteriologist, Orleans Parish.

MAINE:

State board of health—

Charles D. Smith, M. D., president, Portland.
G. M. Woodcock, M. D., Bangor.

MAINE—Continued.

State board of health—Continued.

Richard H. Stubbs, M. D., Augusta.
Marshall P. Cram, Ph. D., Brunswick.
W. L. Haskell, M. D., Lewiston.
Eugene W. Goss, Auburn.
A. G. Young, M. D., secretary, Augusta.

MARYLAND:

State board of health—

William H. Welch, M. D., president, Baltimore.
Marshall Langton Price, M. D., secretary, Baltimore.
Howard Bratton, M. D., Elkton.
James Bosley, M. D., commissioner of health of Baltimore City (ex officio), Baltimore.
Douglas H. Thomas, jr., Baltimore.
Attorney General Isaac Lobe Straus (ex officio), Baltimore.
Louis A. Griffith, M. D., Upper Marlboro.

MASSACHUSETTS:

State board of health—

Henry P. Walcott, M. D., chairman, Cambridge.
Julian A. Mead, M. D., Watertown.
Hiram F. Mills, C. E., Lawrence.
C. E. McGillicuddy, Esq., Worcester.
Clement F. Coogan, Pittsfield.
Robert W. Lovett, M. D., Boston.
Mark W. Richardson, M. D., secretary, Boston.
William C. Hanson, M. D., assistant to the secretary, Boston.

MICHIGAN:

State board of health—

Victor C. Vaughan, M. D., president, Ann Arbor.
Aaron R. Wheeler, M. D., vice president, St. Louis.
R. L. Dixon, M. D., secretary, Lansing.
Charles M. Ranger, A. B., Battle Creek.
John H. Kellogg, M. D., Battle Creek.
Thomas M. Koon, M. D., Grand Rapids.
Edward L. Abrams, M. D., Hancock.

MINNESOTA:

State board of health—

W. A. Jones, M. D., president, Minneapolis.
B. J. Merrill, M. D., vice president, Stillwater.
H. M. Bracken, M. D., secretary and executive officer, St. Paul.
O. T. Sherping, M. D., Fergus Falls.
C. W. More, M. D., Eveleth.
C. Graham, M. D., Rochester.
F. F. Wesbrook, M. D., Minneapolis.
R. O. Earl, M. D., St. Paul.
W. C. Chambers, M. D., Blue Earth.

Laboratory division—

R. H. Mullin, M. D., director.

Epidemiological division—

H. W. Hill, M. D., director.

Engineering division—

Frederic Bass, director.

Mississippi:

State board of health—

E. C. Coleman, M. D., president, Kosciusko.
B. A. Shepherd, M. D., Lexington.
D. J. Williams, M. D., Ellisville.
S. H. McLean, M. D., secretary, Jackson.
John Darrington, M. D., Yazoo City.
T. E. Ross, M. D., Hattiesburg.
G. S. Bryan, M. D., Amory.
L. D. Dickerson, M. D., McComb City.
W. L. Little, M. D., Wesson.
E. A. Cheek, M. D., Arcola.
W. W. Mathis, M. D., Taylor.
J. W. Crumpton, M. D., Starkville.
I. W. Cooper, M. D., Newton.

Missouri:

State board of health—

Ernest F. Robinson, M. D., president, 603 Bryant Building, Kansas City.
Frank B. Fuson, M. D., vice president, Springfield.
Frank B. Hiller, M. D., secretary, Jefferson City.
M. P. Overholser, M. D., Harrisonville.
Ira W. Upshaw, M. D., 5015 Shaw Avenue, St. Louis.
L. E. Bunte, M. D., 3203 Sullivan Avenue, St. Louis.
G. B. Schulz, M. D., Cape Girardeau.

Montana:

State board of health—

Gov. Edwin L. Norris, Helena.
Attorney General Albert J. Galen, Helena.
William Treacy, M. D., president, Helena.
Thomas D. Tuttle, M. D., secretary, Helena.
M. E. Knowles, D. V. S., State veterinarian, Helena.
C. T. Pigot, M. D., Roundup.
D. J. Donohue, M. D., Glendive.

Nebraska:

State board of health—

C. P. Fall, M. D., president, Beatrice.
H. B. Cummins, M. D., vice president, Seward.
Porter F. Dodson, M. D., treasurer, Wilber.
E. Arthur Carr, M. D., secretary, Lincoln.
W. H. Wilson, M. D., State health inspector, Lincoln.

Nevada:

State board of health—

W. H. Hood, M. D., president, Reno.
O. P. Johnstone, M. D., Reno.
S. L. Lee, M. D., secretary, Carson City.

New Hampshire:

State board of health—

Gov. Robert P. Bass, Peterborough.
Attorney General E. B. Eastman, Exeter.
G. P. Conn, M. D., president, Concord.
Charles S. Collins, M. D., Nashua.
Robert Fletcher, C. E., Hanover.
Irving A. Watson, M. D., secretary, statehouse, Concord.

NEW HAMPSHIRE—Continued.

Laboratory of hygiene—

Irving A. Watson, M. D., director, Concord.
Charles D. Howard, B. S., chemist, Concord.
Waldo L. Adams, B. S., assistant chemist, Concord.
H. N. Kingsford, M. D., bacteriologist in charge, Hanover and Concord.
Charles Duncan, M. D., bacteriologist, Concord.
George S. Graham, M. D., assistant bacteriologist, Hanover.
W. S. Purrington, B. S., inspector, Concord.

NEW JERSEY:

State board of health—

John H. Capstick, president, Boonton.
Bruce S. Keator, M. D., secretary, Asbury Park.
George P. Alcott, East Orange.
William H. Chew, Camden.
Herbert W. Johnson, Haddonfield.
Richard C. Newton, M. D., Montclair.

NEW MEXICO:

Territorial board of health and medical examiners—

J. F. Pearce, M. D., president, Albuquerque.
W. E. Kaser, M. D., vice president, Las Vegas.
J. A. Massie, M. B., secretary, Santa Fe.
William D. Radcliffe, M. D., treasurer, Belen.
F. F. Doepp, M. D., Carlsbad.
J. G. Moir, M. D., Deming.
Robert Smart, M. D., Albuquerque.

NEW YORK:

State department of health—

Division of administration—

Eugene H. Porter, A. M., M. D., commissioner.
William A. Howe, M. D., deputy commissioner.
Alec H. Seymour, secretary.

Division of sanitary engineering—

Theodore Horton, C. E., chief engineer.
H. B. Cleveland, C. E., principal assistant engineer.
H. N. Ogden, C. E., special assistant engineer.
C. A. Holmquist, C. E., assistant sanitary engineer.
A. O. True, inspecting engineer.

Division of laboratory work—

William S. Magill, M. D., director State antitoxin and hygienic laboratories.
Thomas Ordway, M. D., director Bender Laboratory.
H. R. Gaylord, M. D., director Cancer Laboratory.
L. M. Wachter, chief sanitary chemist.
W. A. Bing, assistant bacteriologist.

Division of vital statistics—

F. D. Beagle, director.

Division of communicable diseases—

William B. May, M. D., director.

Division of publicity and education—

Hills Cole, M. D., director.

NEW YORK—Continued.

State department of health—Continued.

Consulting staff—

Herbert D. Schenck, M. D., ophthalmologist.
Frederic C. Curtis, M. D., dermatologist.
Harlan P. Cole, M. D., orthopedist.
Walter F. Willcox, Ph. D., statistician.
John B. Garrison, M. D., laryngologist.

Tuberculosis advisory board—

Edward R. Baldwin, M. D., Saranac Lake.
Thomas Darlington, M. D., New York City.
Livingston Farrand, M. D., New York City.
Homer Folks, Esq., New York City.
Alfred Meyer, M. D., New York City.
Veranus A. Moore, M. D., Ithaca.
John H. Pryor, M. D., Buffalo.
William H. Watson, M. D., Utica.
John L. Heffron, M. D., Syracuse.

NORTH CAROLINA:

State board of health—

J. Howell Way, M. D., president, Waynesville.
Richard H. Lewis, M. D., Raleigh.
Edward C. Register, M. D., Charlotte.
J. E. Ashcraft, M. D., Monroe.
David T. Tayloe, M. D., Washington.
J. L. Ludlow, C. E., Winston-Salem.
W. O. Spencer, M. D., Winston-Salem.
Thomas E. Anderson, M. D., Statesville.
Charles O'H. Laughinghouse, Greenville.
W. S. Rankin, M. D., secretary and treasurer, Raleigh.
Warren H. Booker, C. E., assistant to the secretary, Raleigh.

NORTH DAKOTA:

State board of health—

Attorney General Andrew Miller, president, Bismarck.
C. E. Bennett, M. D., vice president, Aneta.
J. Grassick, M. D., secretary, Grand Forks.

OHIO:

State board of health—

William T. Miller, M. D., president, Cleveland.
Frank Warner, M. D., vice president, Columbus.
Oscar Hasencamp, M. D., Toledo.
Josiah Hartzell, Ph. D., Canton.
R. H. Grube, M. D., Xenia.
John W. Hill, C. E., Cincinnati.
H. T. Sutton, M. D., Zanesville.
C. O. Probst, M. D., secretary and executive officer.

OKLAHOMA:

State public health department—

J. C. Mahr, M. D., State commissioner of health, Oklahoma City.
Prof. Edwin DeBarr, chemist, director public health laboratories.
Dr. Gayfree Ellison, bacteriologist.
R. H. Riley, chief clerk.
H. W. Russell, statistical clerk.

OKLAHOMA—Continued.

State public health department—Continued.

U. S. Russell, assistant pure food and drug commissioner.
A. J. Emery, sanitary inspector.
L. D. Allen, sanitary inspector.
H. O. Tener, pure food inspector.
W. G. Short, drug inspector.
Caswell Bennett, pure food inspector.

OREGON:

State board of health—

Andrew C. Smith, M. D., president, Portland.
C. J. Smith, M. D., vice president, Pendleton.
Alfred Kinney, M. D., Astoria.
E. A. Pierce, M. D., Portland.
W. B. Morse, M. D., Salem.
E. B. Pickel, M. D., Medford.
Calvin S. White, M. D., secretary and State health officer, Portland.
Emile F. Pernot, M. S., State bacteriologist, Portland.
W. H. Lytle, State veterinarian, Pendleton.

PENNSYLVANIA:

State department of health—

Samuel G. Dixon, M. D., LL. D., commissioner of health, Harrisburg.
Benjamin Lee, M. D., assistant to commissioner, Harrisburg.
Wilbur Morse, secretary, Harrisburg.
B. Franklin Royer, M. D., chief medical inspector, Harrisburg.
Charles J. Hunt, M. D., associate chief medical inspector, Harrisburg.
Wilmer R. Batt, M. D., registrar of vital statistics, Harrisburg.
Fred C. Johnson, M. D., medical director, Pennsylvania South Mountain Sanatorium for Tuberculosis, Mont Alto.
Thos. H. A. Stites, M. D., medical inspector of dispensaries, Harrisburg.
John A. Bouse, M. D., special medical inspector on organization of local boards of health, Harrisburg.
F. Herbert Snow, chief engineer, Harrisburg.
Henry W. Peirson, chief of the division of distribution of biological products, Harrisburg.
Herbert Fox, M. D., chief of the department of health laboratories, University of Pennsylvania, Philadelphia.

Advisory board—

Adolph Koenig, M. D., Pittsburgh.
Lee Masterson, C. E., Johnstown.
Charles B. Penrose, M. D., Philadelphia.
B. H. Warren, M. D., West Chester.
George W. Guthrie, M. D., Wilkes-Barre.

PORTO RICO:

Dr. E. Lippitt, director of sanitation.

(By a law passed in 1911 the sanitary service of Porto Rico was reorganized. It has been impossible to this date to secure a complete list of members of the board of health.)

RHODE ISLAND:

State board of health—

Alexander B. Briggs, M. D., president, Ashaway.
Samuel M. Gray, C. E., Providence.
Rev. George L. Locke, Bristol.

RHODE ISLAND—Continued.

State board of health—Continued.

Rufus E. Darrah, M. D., Newport.
Gardner T. Swarts, M. D., secretary, Providence.
James O'Hare, Ph. C., Providence.
John H. Bennett, M. D., Pawtucket.
R. Morton Smith, M. D., Riverpoint.

SOUTH CAROLINA:

State board of health—

Robert Wilson, jr., M. D., chairman, Charleston.
H. T. Hall, M. D., Aiken.
C. C. Gambrell, M. D., Abbeville.
E. A. Hines, M. D., Seneca.
W. J. Burdell, M. D., Lugoff.
William Egleston, M. D., Hartsville.
W. M. Lester, M. D., Columbia.
Comptroller General A. W. Jones, Columbia.
Attorney General J. Fraser Lyon, Columbia.
Dr. W. W. Dodson, pharmaceutical member, Laurens.
James A. Hayne, M. D., secretary and state health officer, Columbia.

SOUTH DAKOTA:

State board of health—

W. H. Lane, M. D., president, Miller.
W. L. Vercoe, M. D., vice president, Lead.
O. N. Hoyt, M. D., superintendent and secretary, Pierre.
R. T. Dott, M. D., Salem.
P. B. Jenkins, M. D., Waubay.

TENNESSEE:

State board of health—

T. E. Abernathy, M. D., president, Chattanooga.
Louis Leroy, M. D., vice president, Memphis.
R. E. Fort, M. D., Nashville.
Hon. John Thompson, Nashville.
J. A. Albright, secretary and executive officer, Nashville.
John S. Hamel, assistant to the secretary, Nashville.
Olin West, M. D., assistant secretary for the eradication of hookworm disease.
William Litterer, M. D., State bacteriologist, Nashville.
Lucius P. Brown, pure food and drugs inspector, Nashville.

TEXAS:

State board of health—

Ralph Steiner, M. D., president, Austin.
B. F. Calhoun, M. D., Beaumont.
Hugh McLaurin, M. D., Dallas.
K. H. Beall, M. D., Fort Worth.
B. M. Worsham, M. D., El Paso.
A. W. Fly, M. D., Galveston.
S. M. Lister, M. D., Houston.
R. P. Babcock, secretary, Austin.

UTAH:

State board of health—

F. S. Bascom, M. D., president, Salt Lake City.
W. R. Calderwood, M. D., Salt Lake City.
D. O. Miner, M. D., Nephi.

UTAH—Continued.

State board of health—Continued.

Fred Stauffer, M. D., Salt Lake City.
A. F. Doremus, C. E., Salt Lake City.
T. B. Beatty, M. D., secretary, Salt Lake City.
H. K. Merrill, M. D., Logan.

VERMONT:

State board of health—

C. S. Caverly, M. D., president, Rutland.
H. D. Holton, M. D., secretary, Brattleboro.
F. Thomas Kidder, M. D., treasurer, Woodstock.

VIRGINIA:

State department of health—

(Office and laboratories, 1110 Capitol Street, Richmond.)

Ennion G. Williams, M. D., health commissioner.
Allen W. Freeman, M. D., assistant commissioner.
Meade Ferguson, Ph. D., bacteriologist.
Richard Messer, C. E., sanitary engineer.
Roy K. Flannagan, M. D., director of inspections.

Board of health—

R. W. Martin, M. D., president.
W. M. Smith, M. D., secretary.
S. W. Hobson, first congressional district, Newport News.
L. T. Royster, M. D., second congressional district, Norfolk.
J. B. Fisher, M. D., third congressional district, Midlothian.
O. C. Wright, M. D., fourth congressional district, Jarratts.
Lewis E. Harvie, M. D., fifth congressional district, Danville.
R. W. Martin, M. D., sixth congressional district, Lynchburg.
T. C. Firebaugh, M. D., seventh congressional district, Harrisonburg.
W. M. Smith, M. D., eighth congressional district, Alexandria.
J. H. Dunkley, M. D., ninth congressional district, Saltville.
Reid White, M. D., tenth congressional district, Lexington.
George Ben Johnston, M. D., city of Richmond.
Stuart McGuire, M. D., city of Richmond.

WASHINGTON:

State board of health—

Edwin L. Kimball, M. D., president, Spokane.
Wilson Johnston, M. D., Spokane.
Elmer E. Heg, M. D., secretary and State commissioner of health, Seattle.
James R. Yocom, M. D., Tacoma.
S. B. Nelson, D. V. S., Spokane.
P. Frank, M. D., North Yakima.
Eugene R. Kelley, assistant State commissioner of health.
Edward P. Fick, State bacteriologist.
Myrtle V. Goodman, assistant State registrar.

WEST VIRGINIA:

State board of health—

C. W. Halterman, M. D., Clarksburg.
C. A. Wingerter, M. D., Wheeling.
L. S. Brock, M. D., Morganton.
W. W. Golden, M. D., Elkins.
M. V. Godbey, M. D., Charleston.
J. E. Robins, M. D., Charleston.

WEST VIRGINIA—Continued.

State board of health—Continued.

A. N. Frame, M. D., Parkersburg.
H. M. Rymer, M. D., Harrisville.
R. E. Vickers, M. D., president, Huntington.
H. A. Barbee, M. D., secretary and executive officer, Point Pleasant.

WISCONSIN:

State board of health—

William F. Whyte, M. D., president, Watertown.
C. H. Sutherland, M. D., Janesville.
E. S. Hayes, M. D., Eau Clair.
L. E. Spencer, M. D., Wausau.
Hasso A. Meilike, M. D., Clintonville.
C. A. Harper, M. D., secretary and executive officer, Madison.
Lawrence P. Mayer, M. D., Hudson.

WYOMING:

State board of health—

Fred Horton, M. D., president, Newcastle.
A. W. Barber, M. D., secretary and executive officer, Cheyenne.
D. E. Brown, M. D., Diamondville.

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